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CANADIAN FORCES TECHNICAL ORDER

AIRCRAFT OPERATING INSTRUCTIONS

MUSKETEER
CT 134A

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FOREWORD

1. This Canadian Forces Technical Order (CFTO) is divided into five Parts: General, Description, Normal Operating Procedures, Emergency Operating Procedures, Operating Data, and Flight Testing Procedures.

2. PART 1 - GENERAL DESCRIPTION - describes and illustrates the controls, systems, and equipment with which the pilot should be acquainted.

3. PART 2 - NORMAL OPERATING PROCEDURES - describes the normal handling of the aircraft by the pilot.

4. PART 3 - EMERGENCY OPERATING PROCEDURES - details the emergency handling of the aircraft by the pilot.

5. PART 4 - OPERATING DATA - gives the flying and engine limitations and includes information on fuel consumption, range, and endurance under various conditions of flight.

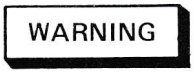
6. PART 5 - FLIGHT TESTING PROCEDURES - lists the procedures to be followed and the performance standards to be attained during flight testing of the complete aircraft or an individual system after maintenance.

7. As a rule, words written in capital letters throughout the text indicate actual markings on the controls concerned.

8. Comments and suggestions should be forwarded through the usual channels to the Commander, Air Command, attention: Deputy Chief of Staff Air Operations and Training (DCOS OPS AND TRG).

9. Danger, Warning, Caution, and Note headings are defined a follows:

To draw attention to an extreme, violent and continuous hazard to life.



To emphasize operating procedures, practices, etc, which, if not correctly followed, could result in personal injury or loss of life.

To emphasize operating procedures, practices, etc, which, if not correctly followed, could result in damage to or destruction of equipment.

NOTE - To point out a procedure, event, or practice which it is desirable or essential to highlight.

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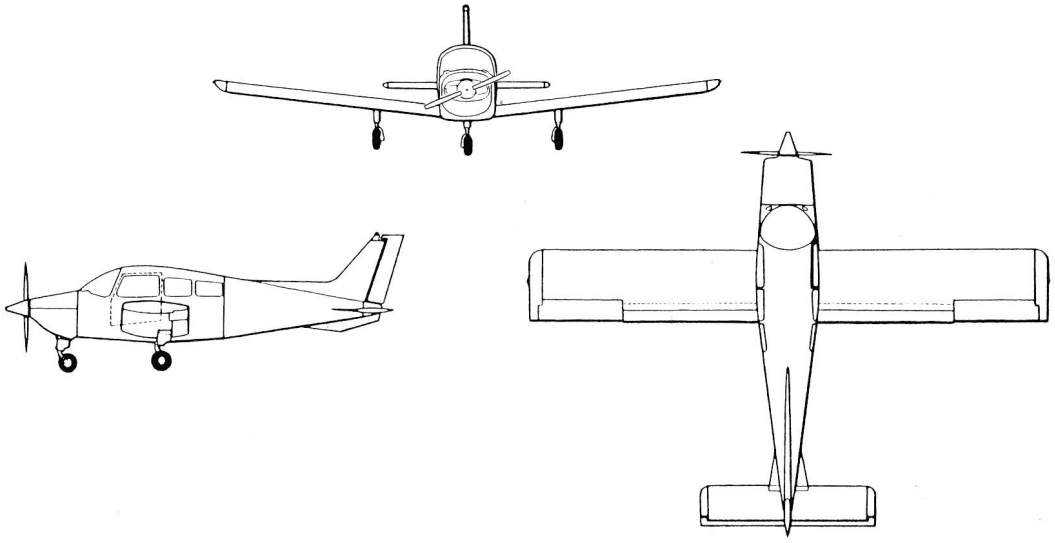
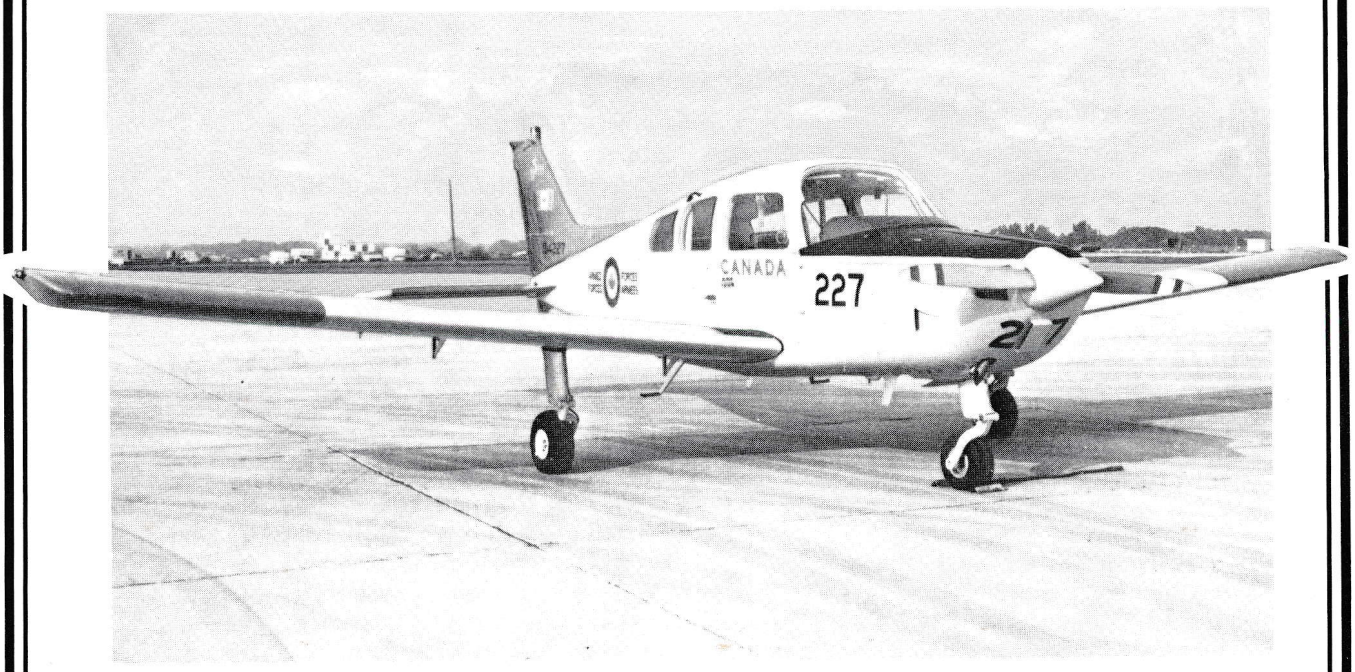




Musketeer

CT 134A

PART I

GENERAL DESCRIPTION

INTRODUCTION

1. The Musketeer CT 134A, manufactured by Beech Aircraft Corporation, is a single-engine, IFR certified, four-place, all-metal, low-wing monoplane with fixed tricycle landing gear. Dual controls are provided for side-by-side seating of instructor and student. The Lycoming 0-360-A4K engine develops 180 brake horsepower (BHP) under sea-level-standard conditions at 2700 RPM and drives a two-bladed, fixed-pitch, forged-aluminum propeller. The fuselage is of all-metal, honeycomb reinforced, semi-monocoque construction. The wings are of all-metal, bonded cantilever construction. Fuel tanks are located in the root section of the wing. Fowler-type metal flaps are incorporated at the inboard trailing edge of the wings, as are all-metal ailerons on the outboard section of the wings. The tail assembly comprises of an all-metal horizontal stabilator and a swept-back all-metal fin and rudder. The engine cowling is of reinforced fibreglass. The rear portion of the dorsal fairing, wing tips, stabilator tips and rudder tip are moulded of Royalite composition material. See Figure 1-1 for general arrangement, and Figure 1-2, for aircraft dimensions.

LEADING PARTICULARS

DIMENSIONS

2. Overall dimensions are as follows (see Figure 1-2):

a.	Length	25 feet 9 inches
b.	Span	32 feet 9 inches
c.	Height	8 feet 3 inches
d.	Wheel track	11 feet 10 inches

WEIGHTS

3. Weights are as follows:

a. Basic weight (including removable equipment, but excluding crew or fuel) is approximately 1650 pounds.

b. Maximum permissible take-off weight, ie, when aircraft is employed in the Normal category, is 2450 pounds.

c. Maximum permissible weight for aerobatics ie, when aircraft is employed in the aerobatic category, is 2250 pounds.

FUEL AND OIL TANK CAPACITIES

4. Total tank capacities are as follows:

a. Fuel - 227 litres (50 Imp gal) of which 223 litres (49 gal) are usable.

b. Oil - 7.5 litres (6.65 Imp quarts) of which 5.6 litres (5 quarts) are usable.

FUEL SYSTEM

GENERAL

5. Fuel is contained in the forward inboard section of each wing. Capacity of each tank is 114 litres (25 gal), of which 111 litres (24.5 gal) are usable. A visual measuring tab, located in the filler neck of each tank, allows the tank to be filled to a 54-litre (12 gal) (bottom of tab) or 73-litre (16 gal) (slot of tab) capacity. Fuel is supplied to the carburettor through a fuel selector valve, a fuel strainer/drain, and the engine-driven fuel pump. See Fuel System diagram, Figure 1-3.

FUEL SELECTOR

6. The fuel selector is located on the cockpit floor forward of trim control post and is accessible from both seats (see Figure 1-7). The selector is mechanically linked to the fuel selector valve and has three positions: OFF, L TANK and R TANK. Each position is a positive detent, and the selector must be lifted to change its position.

CAUTION

Ensure that the fuel selector is in the 'detent' position for either the left or right fuel tank. Any selection other than 'detent' position may allow the engine to continue running indefinitely at a low power setting, but, without warning, may cause fuel starvation and subsequent engine failure.

NOTE - During side slips involving large rudder deflections held for more than 30 seconds, place the fuel selector so that the tank on the high-wing side is selected, otherwise engine fuel starvation may occur.

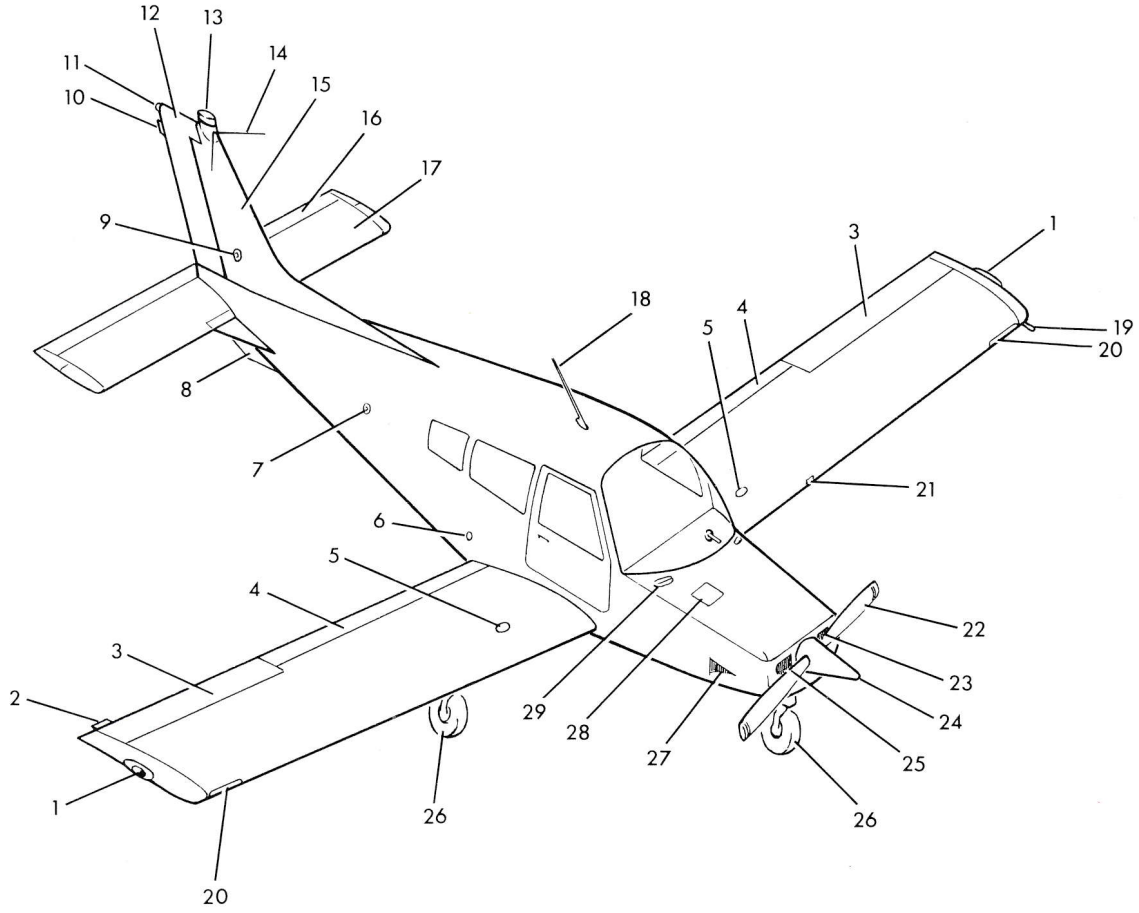
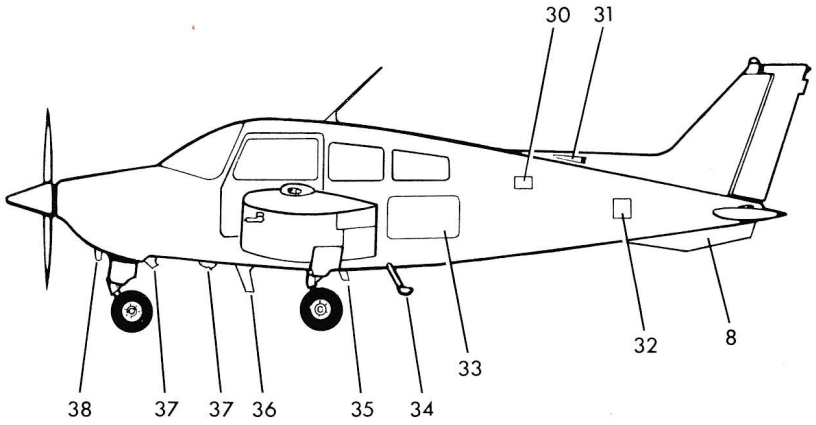


Figure 1-1 (Sheet 1 of 2) General Arrangement



1 NAVIGATION AND WING STROBE
2 FIXED AILERON TRIM TAB
3 AILERON
4 FLAP
5 FUEL-TANK FILLER CAP
6 EXTERNAL POWER RECEPTACLE
7 STATIC PRESSURE SOURCE
8 VENTRAL FIN
9 DAL ANTENNA (Both Sides)
10 FIXED RUDDER TRIM TAB
11 REAR NAVIGATION LIGHT
12 RUDDER
13 ROTATING BEACON
14 VOR AND ILS ANTENNAE
15 VERTICAL STABILIZER
16 STABILATOR TRIM
17 STABILATOR
18 VHF ANTENNA
19 PITOT HEAD
20 LANDING LIGHT
21 STALL-WARNING VANE
22 PROPELLER
23 AIR INTAKE – OIL COOLER
24 PROPELLER SPINNER
25 AIR INTAKE – CABIN HEAT
26 LANDING GEAR
27 AIR INTAKE – CABIN COLD AIR
28 OIL FILLER ACCESS DOOR
29 AIR INTAKE – COCKPIT OUTLET (Two)
30 EXHAUST VENT (Left Side Only)
31 AIR INTAKE – CABIN (Left Side Only)
32 DAL TRANSMITTER (Left Side Only)
33 BAGGAGE COMPARTMENT DOOR (Left Side Only)
34 STEP
35 TRANSPONDER ANTENNA
36 ADF ANTENNA
37 DRAINS AND VENT LINES
38 EXHAUST PIPE

Figure 1-1 (Sheet 2 of 2) General Arrangement

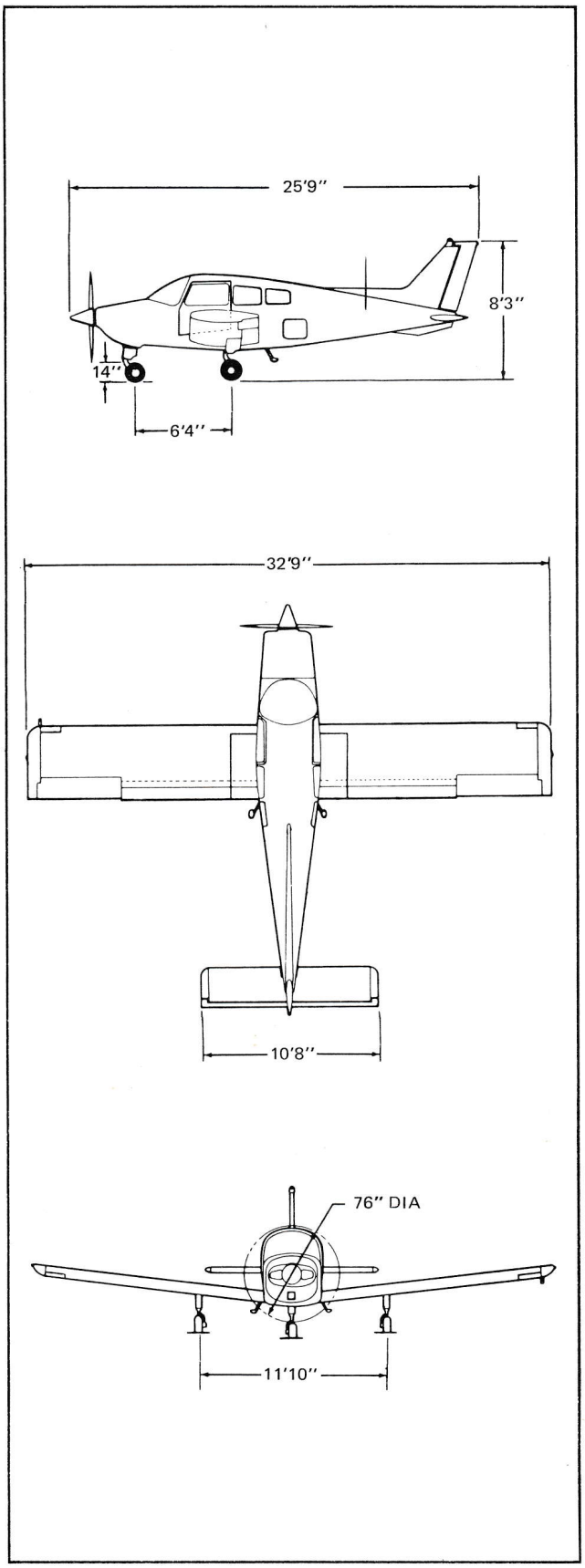


Figure 1-2 Aircraft Dimensions

FUEL PRESSURE GAUGE

7. The fuel pressure gauge, located on the instrument panel (Figure 1-6), is graduated in pounds per square inch (PSI) from 0 to 15 PSI. The normal operating range is 0.5 to 6 PSI.

FUEL QUANTITY GAUGES

8. Two eyebrow fuel gauges, one for each tank, are located on the instrument panel above the throttle quadrant. Fuel quantity-sensing units are located on each fuel cell. The scales indicate fractionally as follows:

Full - 73 litres (16 gal) or more.

Half - 54 litres (12 gal) each tank.

ENGINE PRIMING SYSTEM

9. The control for the manually operated engine primer pump is located on the lower left sub-panel (see Figure 1-6). The priming line takes fuel from the fuel system at the fuel strainer and injects it into all four cylinders through a priming induction system mounted on top of the engine.

ENGINE-DRIVEN FUEL PUMP

10. The engine-driven pump is mounted at the rear of the engine. Fuel is pumped from the fuel strainer into the carburettor.

FUEL BOOST PUMPS

11. There are two electrically-driven fuel boost pumps: both are located beneath the cabin floor boards. They are installed in a separate line, running from the fuel strainer to the carburettor. The pumps are controlled by a three-position toggle switch, located on the instrument sub-panel (see Figure 1-6). The upper position of the switch operates the No. 1 pump, which is used for all conditions of flight. The centre position is a common 'off' position, and the lower position operates the No. 2, or back-up, boost pump.

FUEL SYSTEM DRAIN VALVES

12. Drain valves, spring-loaded to the closed position, are provided at several points in the fuel system:

a. Fuel cells, at lowest point of each.

b. Fuel strainer, lowest point of fuel system.

c. Engine-driven fuel pump.

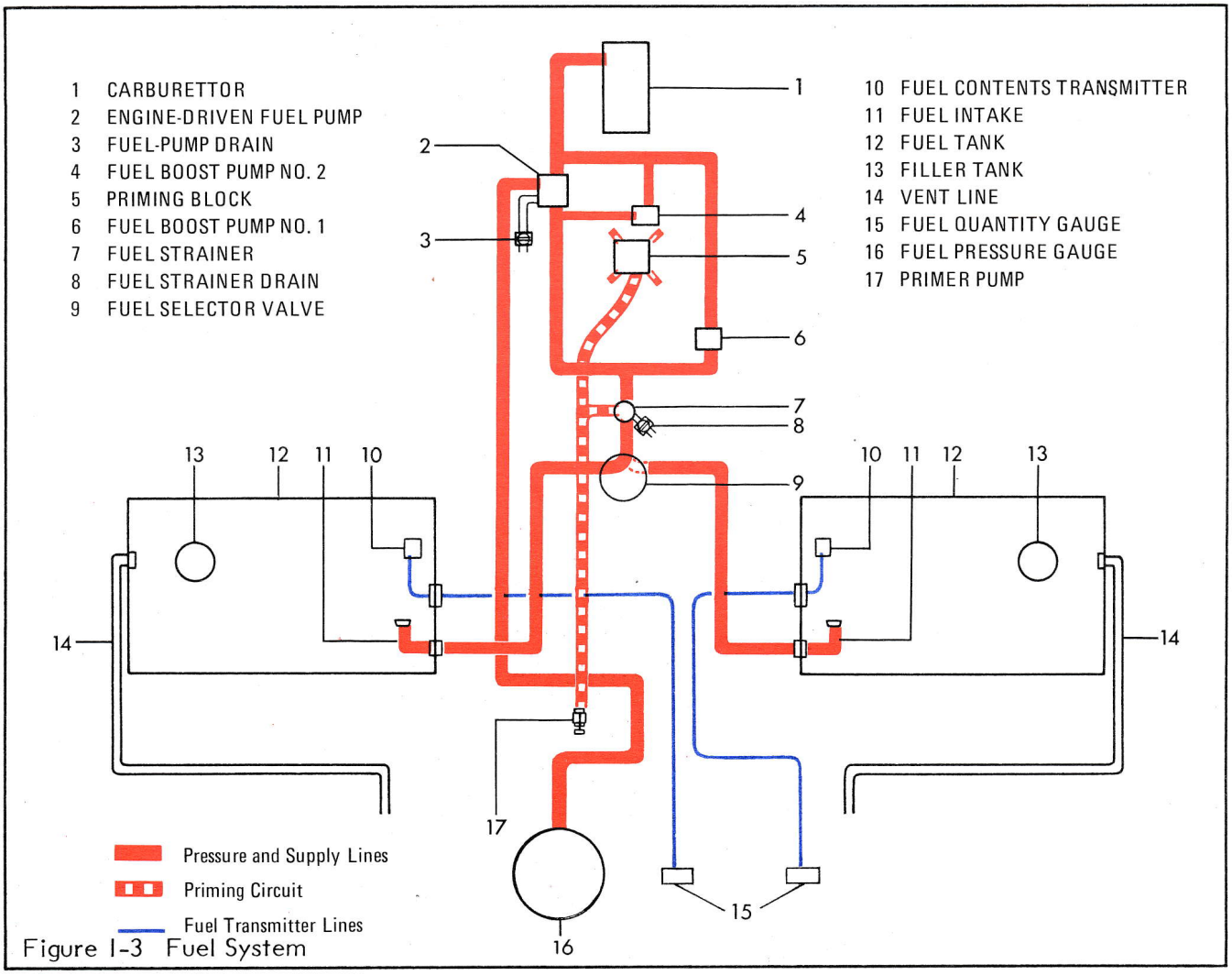


Figure 1-3 Fuel System

FUEL SPECIFICATIONS

13. Fuel specifications are as follows:

a. Standard for Canadian Forces - 100/130, CAN 2-3.25 (NATO F-18).

b. Acceptable - 115/145, CAN 2-3.25 (NATO F-22); and 100LL, CAN 2-3.25 (NATO F-18).

OIL SYSTEM

GENERAL

14. The oil system is a wet-sump system. The filler tube is located at the right rear of the engine. It has a threaded cover which should be finger-tight for normal aircraft operations. Oil enters the engine in the crankcase area and is drained down into the oil sump where it is picked up by an engine-driven impeller-type pump and pumped up to the top of the engine through an oil-pressure relief valve and a thermostatic oil bypass valve. When the oil is warm, it flows to the cooler located at the left air intake of the engine cowling; the cooled oil is passed back to the top of the engine and to the other side of the thermostatic oil bypass valve. It is then sprayed into the top section of the engine to lubricate valves, push rods, and other components. When the oil is cold, the thermostatic oil bypass valve prevents it from flowing to the cooler and causes it to be sprayed directly into the upper part of the engine. See Oil System diagram, Figure 1-4.

OIL GAUGES

15. Oil pressure and temperature are indicated on two eyebrow gauges located in the centre of the instrument panel between the ammeter and the right fuel gauge (see Figure 1-6). Oil pressure, in PSI, is taken at the thermostatic oil bypass valve of the oil system. The normal operating range for oil pressure is 60 to 90 PSI, with a maximum of 100 PSI for start and warm-up, and a minimum, for

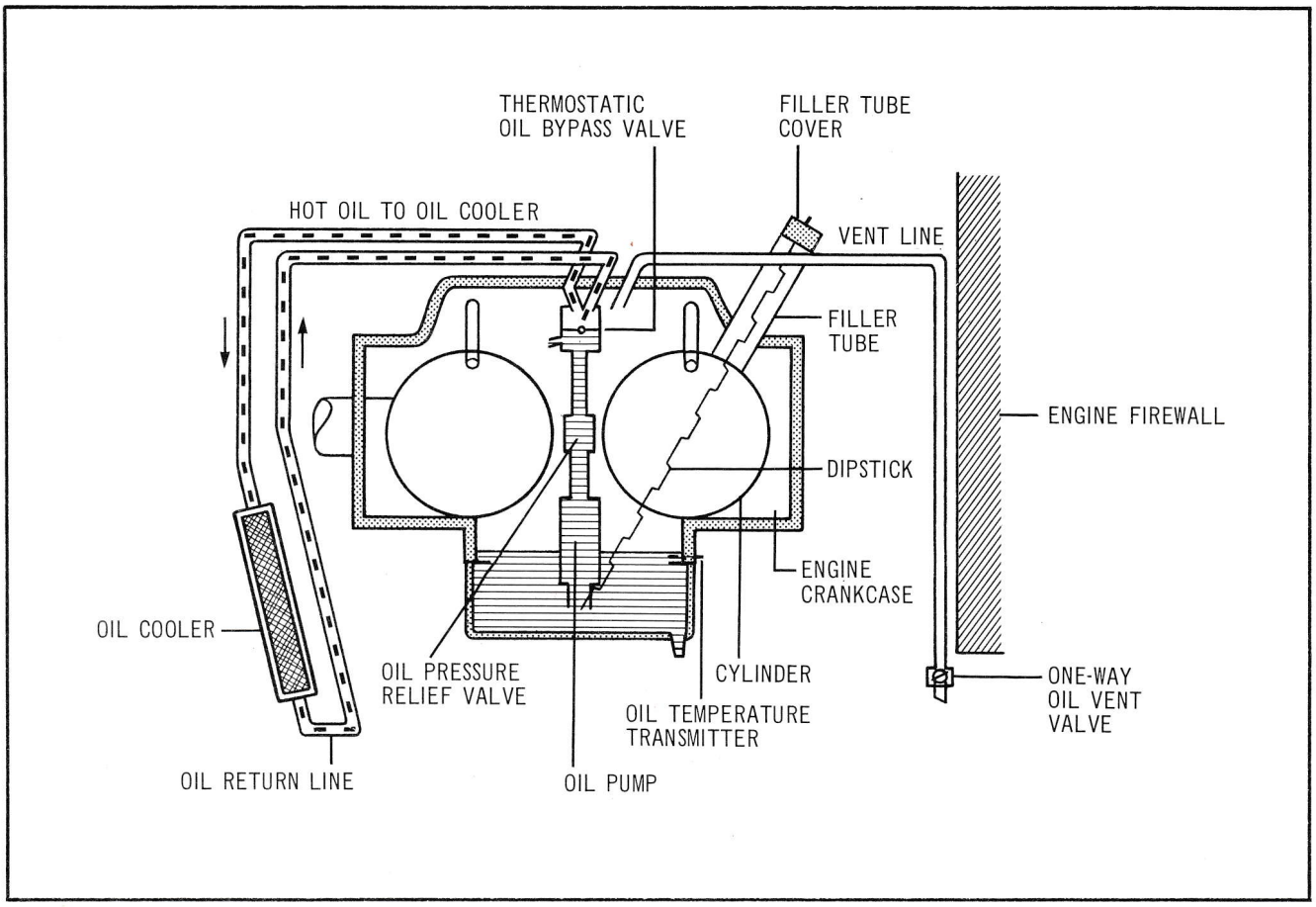


Figure 1-4 Oil System

idling, of 25 PSI. Oil temperature is taken by an oil temperature transmitter fitted at the lower left side of the crankcase. The gauge is calibrated in degrees Fahrenheit: normal operating range is 120° to 245° F (maximum of 245° F) and a cautionary range between 60° and 120° F.

OIL COOLER

16. A radiation-type oil cooler is installed in the left air intake of the engine cowling. When the thermostatic oil bypass valve is open, oil is fed to the cooler from the valve for cooling, then back to the other side of the thermostatic oil bypass valve where it re-enters the engine.

OIL SPECIFICATIONS

17. The following oils may be used:

Canadian Military	NATO
3-GP-315	O-123
3-GP-321	O-128

ELECTRICAL SYSTEM

GENERAL

18. Direct current (DC) is supplied to the bus and alternator field circuit by a 24-volt, 35-ampere-hour, wet-cell, lead-acid battery whenever the BTY switch is turned ON. A 28-volt, 60-ampere-hour DC alternator starts when the ALT switch is turned ON and supplies power to the bus and to the alternator field circuit. From the bus, electricity is fed to the electrical equipment and to the battery to charge it.

ELECTRICALLY-OPERATED EQUIPMENT

19. The following equipment is operated by the electrical system: starter, interior lights, instrument lights, navigational/position lights, landing lights, strobe lights, intercom, pitot heat, ADF radio, VOR/ILS, transponder, VHF radio, stall-warning indicator, rate-of-turn

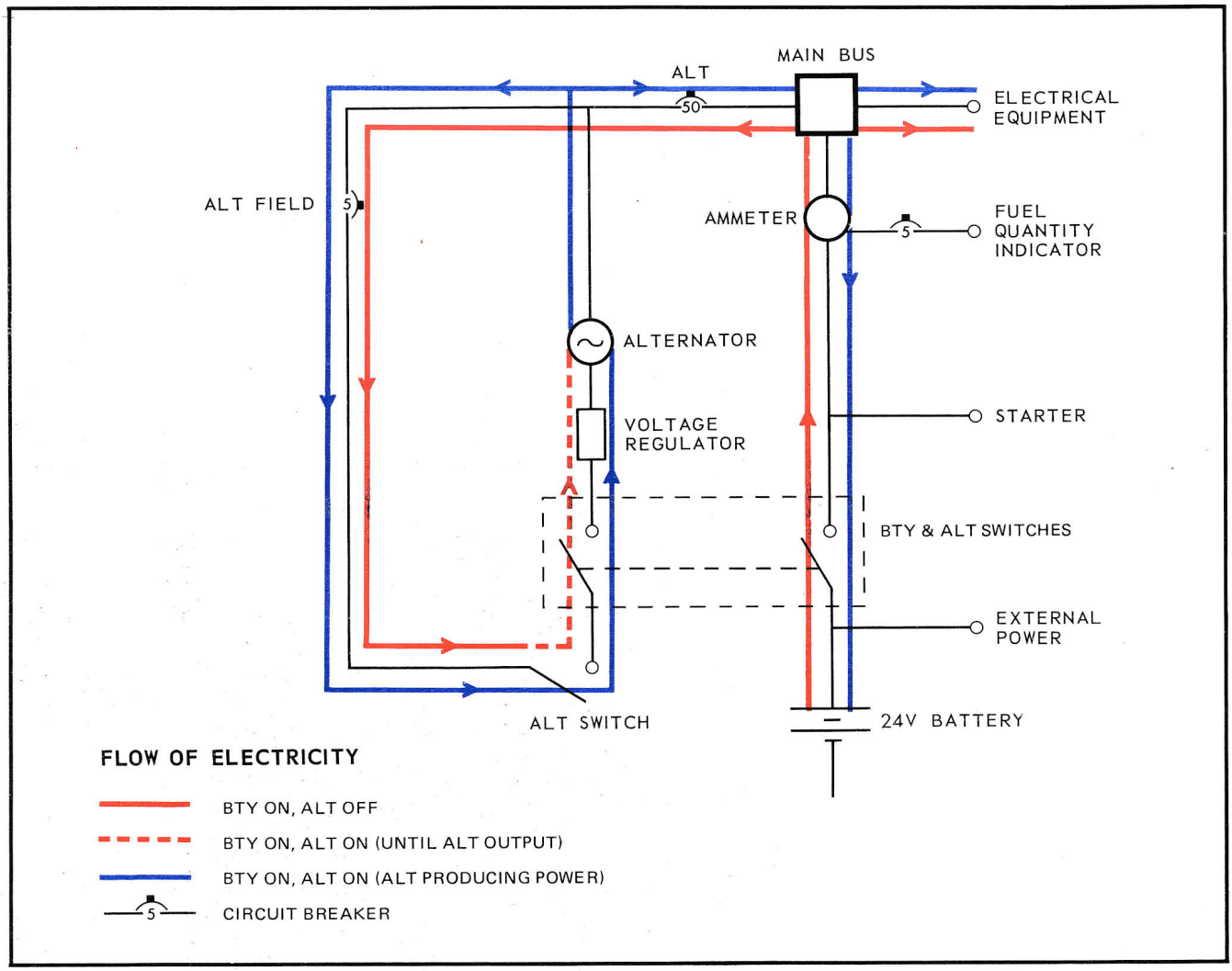


Figure 1-5 Electrical System - Schematic

pointer, fuel boost pumps, carburettor-air temperature gauge, oil temperature gauge, and fuel gauges. All equipment is protected by circuit breakers, located on the lower right sub-panel (see Figure 1-6).

EXTERNAL POWER RECEPTACLE

20. A receptacle for connecting an external power supply (24-volt DC) is located on the right side of the fuselage, aft of the wing root (see Figure 1-1).

AMMETER

21. The ammeter indicates current flow to and from the battery and is located on the instrument panel between the fuel gauges (see Figure 1-6). The ammeter pointer indicates zero (centre of scale) when no current is drawn from or supplied to the battery. It indicates a negative reading when current is being drawn from the battery and a positive reading when the battery is being charged.

BATTERY SWITCH

22. The battery switch (BTY) is located on the lower sub-panel left of the throttle quadrant (see Figure 1-6). It functions as a master switch, cutting power to all electrically operated equipment. When turned ON, it supplies power to the bus and from there to the electrical equipment and to the alternator field circuit (solid red line, Figure 1-5). The battery switch must be turned ON to operate the starter, whether external power is used or not.

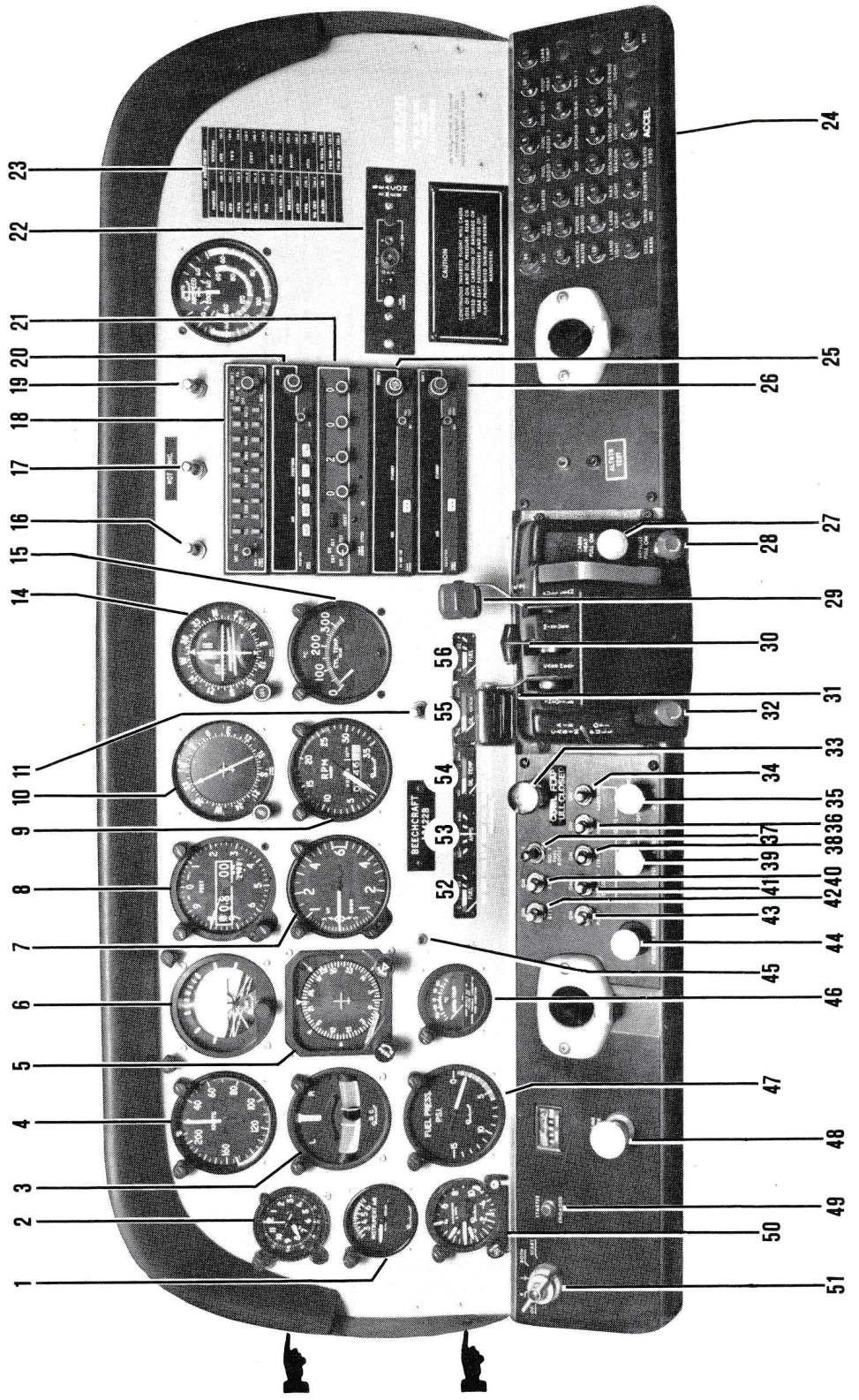


Figure 1-6 (Sheet 1 of 2) Instrument Panel

1 Instrument-Air Gauge
2 8-Day Clock
3 Turn-and-Slip Indicator
4 Airspeed Indicator
5 Main-Compass System
6 Attitude Indicator
7 Vertical-Speed Indicator
8 Altimeter
9 Tachometer
10 ADF Indicator
11 Mute Switch
12 Compass DELETED
13 Magnetic Compass
14 VOR/ILS Indicator
15 Cylinder-Head Temperature Gauge
16 Avionics-Master Switch
17 Intercom-System Switch
18 Selector Panel
19 Standby-Phone Switch
20 ADF Control Panel
21 Transponder
22 DAL Panel
23 Frequency Panel
24 Circuit-Breaker Panel
25 VHF Transponder
26 VOR/ILS Receiver
27 Cabin-Heat Control
28 Cabin-Defrost Control
29 Mixture Control
30 Carburettor-Heat Control
31 Throttle Control
32 Cabin-Air Volume Control
33 Cowl-Flap Control
34 Landing-Light Switch
35 Overhead-Light Switch
36 Navigation-Light Switch
37 Fuel-Boost-Pump Switch
38 Wing-Strobe Switch
39 Post-and-Panel-Light Switch
40 Alternator Switch
41 Rotating-Beacon Switch
42 Battery Switch
43 Pitot-Heat Switch
44 Parking-Brake Control
45 Slave-Gyro Switch
46 Carburettor-Air-Temperature Gauge
47 Fuel-Pressure Gauge
48 Engine-Primer Control
49 Starter-Engaged Light
50 Accelerometer
51 Magneto-Start Switch
52 Fuel-Quantity Gauge (Left)
53 Ammeter
54 Oil-Temperature Gauge
55 Oil-Pressure Gauge
56 Fuel-Quantity Gauge (Right)
57 Transmit/Mute Switch

Figure 1-6 (Sheet 2 of 2) Instrument Panel

ALTERNATOR SWITCH

23. The alternator (ALT) switch is located on the right side of the lower left sub-panel between the BTY switch and the FUEL BOOST pump switch (see Figure 1-6). The ALT switch must be turned off during start-up to prevent damage to diodes in the alternator. When the ALT switch is turned ON, the field circuit is closed (dotted red line, Figure 1-5), and the alternator starts producing power (solid blue line, Figure 1-5). The alternator then supplies electricity to the bus and its own field circuit. The alternator is protected from main bus overload by a 50-ampere circuit breaker. The alternator field circuit is protected by a 5-ampere circuit breaker. Both circuit breakers are located in the upper right-hand corner of the circuit-breaker panel.

CIRCUIT BREAKERS

24. Circuit breakers installed on the lower right corner of the sub-panel protect most electrical circuits in the aircraft. All circuit breakers are of the external popping type. When a circuit is overloaded, the head of the circuit breaker will pop out and a white band is visible at the base of the circuit breaker.

WARNING

Deactivation of the BTY switch, the ALT switch, or ALT circuit breaker during flight is prohibited, except as required in an actual emergency.

POWER PLANT

ENGINE

25. The aircraft is powered by an AVCO Lycoming 0-360-A4K engine which develops 180 brake horsepower under sea-level-standard conditions and 2700 RPM. It is a four-cylinder, horizontally opposed, air-cooled engine, with a direct-drive, 76-inch, all-metal, fixed-pitch Sensenich propeller. Engine displacement is 360 cubic inches.

ENGINE TACHOMETER

26. The engine tachometer is located on the instrument panel to the right of the Vertical Speed Indicator (VSI) (see Figure 1-6), and is calibrated in RPM x 100. Incorporated in the instrument is an engine running-time meter which records total engine running time.

CYLINDER-HEAD TEMPERATURE GAUGE

27. The cylinder-head temperature is taken by a probe installed in the bayonet thermocouple receptacle of No. 3 cylinder, which is the hottest cylinder.

THROTTLE CONTROL

28. The throttle control is located at the left side of the engine control quadrant (see Figure 1-6). It is of the quadrant-mounted throttle type; forward to increase, aft to decrease.

MIXTURE CONTROL

29. The MIXTURE control controls the fuel-air ratio in the carburettor. It is mounted on the right of the throttle quadrant (see Figure 1-6). In the fully forward position, against the panel, the fuel-air mixture is rich, and when the control is fully aft, the mixture control is in the idle cut-off position. There are two locks incorporated on the throttle quadrant. The first, located in the right-hand edge of the quadrant, locks all three levers when pulled down. The second is an indent which permits locking of the mix control in the full-rich position.

CARBURETTOR HEAT CONTROL

30. The carburettor heat (CARB HEAT) control operates a butterfly valve installed in a T-fitting at the carburettor intake manifold. Hot air is drawn from the area of the exhaust manifold. In the fully forward position, against the panel, the butterfly valve is closed and only cold air is passed to the carburettor intake. With the control pulled back, hot air is passed to the carburettor intake. The temperature of the air in the carburettor throat is indicated on the caburettor-air temperature gauge.

ENGINE MAGNETO/START SWITCH

31. The engine magneto/START switch is an ignition-type switch located on the lower left sub-panel (see Figure 1-6). It incorporates five positions: OFF, R, L, BOTH, and START. In the OFF position, both magnetos are off; at R, only the right magneto is live; at L, only the left magneto is live; at BOTH, both sets of magnetos are live; and at START, the starter is engaged, and the left magneto is live and supplied with an augmented starting impulse. The switch is spring-loaded in the START position and returns to the BOTH position when released.

ENGINE STARTER

32. The Lycoming-supplied engine starter is activated as outlined in the preceding paragraphs and includes a starter warning light located right of the MAG switch.

CAUTION

Maximum duration of engine starter operation is 30 seconds. A minimum 5-minute cooling period must be observed before starter is re-engaged.

CAUTION

The warning light labelled STARTER ENGAGED illuminates whenever electrical power is being supplied to the starter. If the light remains illuminated after starting, the starter relay has remained engaged, and loss of electrical power and possible equipment damage will eventually result. Turn the BTY switch and ALT switch off. If in flight, land as soon as practical. If the light does not illuminate during starting, the indicator system is inoperative and the ammeter must be monitored to ensure that the starter does not remain energized after releasing the magneto/START switch.

FLIGHT CONTROLS

GENERAL

33. The control surfaces are operated by 'ram's horn' yokes and rudder pedals from either front seat of the cockpit (see Figure 1-7). All control movements are transmitted by cables and mechanical linkages.

CONTROL LOCK

34. Aileron and stabilator controls may be locked by the insertion of a pin which engages both the control yoke and the sleeve through which it passes.

RUDDER PEDALS AND RUDDER

35. The rudder pedals (see Figure 1-7) are conventional and incorporate toe brakes. Adjustment for the rudder pedals is achieved by moving either seat fore and aft. The pedals are connected to the rudder via cables and pulleys to a bell crank at the base of the rudder. The pedals are also connected to a steering cam mounted at the top of the nose-wheel strut by means of a spring-loaded strut which serves as a damper to minimize steering shocks being transmitted back to the rudder pedals. On the ground, the rudder is prevented from swinging excessively by the centring action of the nose wheel; therefore, no control lock is provided for the rudder. The rudder is rigged so that the control surface stays 2-1/2 degrees right of the trail position to counteract slip-stream effect.

AILERONS

36. The ailerons (see Figure 1-1) are of the slotted type; they are highly responsive at slow airspeeds, even when the aircraft is stalled. They are of all-metal, ribbed construction and are interconnected with the rudder control. Full rudder deflection applies one-half inch of aileron movement in the direction of the applied rudder.

CAUTION

Dishing of the aileron surface may significantly affect the flight characteristics, causing the aircraft to fly wing-high or wing-low. To prevent dishing, avoid pushing or squeezing the aileron during ground handling.

STABILATOR

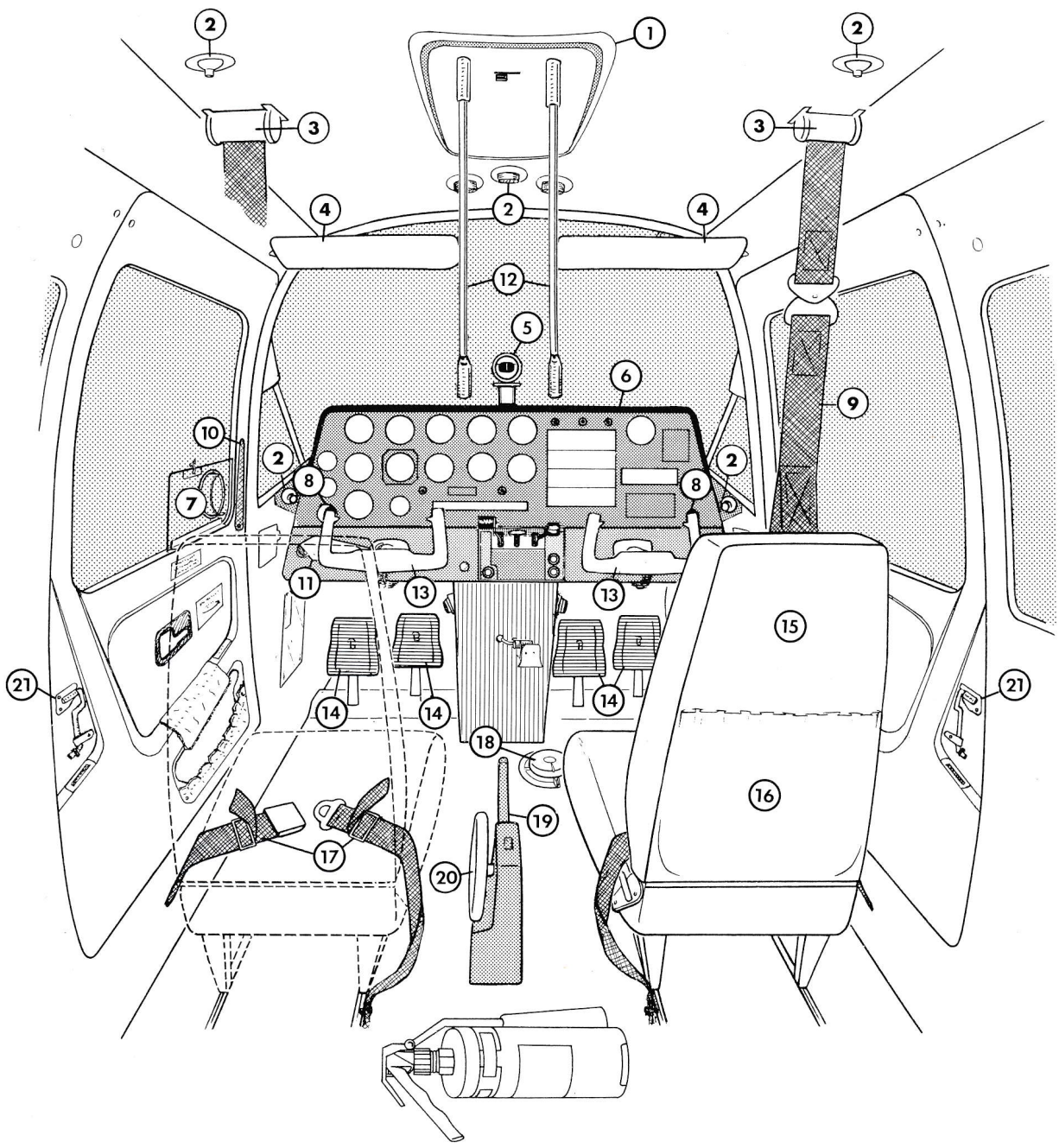
37. The stabilator (see Figure 1-1) is of all-metal, bonded construction, except for the tips, which are moulded of Royalite composition material. It is of the 'flying' tailplane type, so called because the entire tailplane surface moves. The stabilator is controlled by fore-and-aft movement of the control yoke. Cables from the control yoke are attached to a balance weight arm on the stabilator.

CAUTION

Full deflection of the stabilator should not be applied harshly, as stops may be damaged, causing structural damage to the aft fuselage.

ANTI-SERVO TRIM TAB

38. A full-span anti-servo trim tab is attached to the stabilator in such a manner that for each degree of deflection of the stabilator, the anti-servo trim tab is deflected 1 degree in the same direction.



1 OVERHEAD CONSOLE
2 FRESH-AIR VENT
3 INERTIA REEL
4 SUN VISOR
5 STANDBY COMPASS
6 INSTRUMENT PANEL
7 STORM VENT
8 TRANSMIT BUTTON
9 SHOULDER HARNESS
10 DOOR QUICK-RELEASE HANDLE (Both Doors)
11 CONTROL LOCK
12 TELECOM JACKS
13 CONTROL YOKE
14 RUDDER PEDALS
15 BUCKET SEAT
16 MAP CASE
17 LAP BELT
18 FUEL SELECTOR
19 FLAP LEVER
20 TRIM WHEEL
21 DOOR-SECURING ARM

Figure 1-7 Cockpit Layout

TAIL SECTION

39. The tail section (see Figure 1-1) consists of a dorsal fin with a fillet of Royalite composition material; the swept-back vertical fin, on which the rotating beacon and the VOR/ILS antenna are mounted; and the rudder. All are of all-metal, bonded construction, except for the fillet, and the rudder, which is of ribbed metal construction. The rudder also incorporates a horn balance to lighten control forces. As noted above, the rudder control is interconnected to the aileron controls. In line with, and directly below the vertical fin, is the ventral fin.

CAUTION

Scraping the ventral fin can be a hazard, because its anchor point is in the vicinity of the anchor point of the stabilator cable and pulley. If the ventral fin is hit hard enough and/or with crab on, the stabilator cable and pulley may be damaged.

TRIM

40. Trim tabs are provided for the ailerons, rudder, and stabilator; however, only the last is controllable during flight. A stabilator trim wheel is centrally located between the pilot seats (see Figure 1-7). Forward rotation of the trim wheel relieves control pressure in the forward direction of the pitching plane, and vice versa. Aileron trim consists of a metal tab affixed to the right aileron, 4 inches inboard of the right wing tip. Rudder trim consists of a metal tab affixed to the trailing edge of the rudder, approximately 2 inches below the rear navigation light. Adjustment of these trim tabs is not normally required, but, when adjustment is needed, it should be performed by qualified personnel with the appropriate tool.

FLAPS

41. The aircraft is equipped with Fowler-type flaps of all-metal, ribbed construction. They extend from the fuselage to the inboard end of the ailerons. Operation is manual - controlled by the flap lever mounted on the post between the pilot seats (see Figure 1-7). Flaps may be set in any of four positions: 0°, 15°, 25°, and 35°. Flap lowering is accomplished by simply raising the lever. Maximum IAS for any flap extension is 96 knots. The flaps will automatically lock at each setting in turn as the lever is raised. To retract the flaps, a spring-loaded release plunger, located in the end of the flap lever, must be depressed while the lever is moved down. Augmenting the slip-stream's closing effect, the flaps are spring-tensioned toward the 'retracted' (zero-degree) position.

STALL WARNING SYSTEM

42. A stall-warning buzzer, located in the overhead speaker console, sounds a warning 4 to 6 knots above a stalled condition. The audio signal sounds continuously until the angle of attack is reduced. The stall-warning system, activated by a sensing vane on the leading edge of the left wing (see Figure 1-1), is equally effective in all flight configurations and at all weights.

NOTE - With the battery (BTY) switch in the OFF position, the stall-warning buzzer is inoperative.

LANDING GEAR

GENERAL

43. The non-retractable, tricycle-type landing gear (see Figure 1-1) consists of housing constructed of magnesium castings and aluminum forgings, in which rubber compression discs are inserted to absorb shocks. The three landing-gear struts are identical, except for the pivoting and steering provisions on the nose wheel and brake attachment points on the main gear.

MAIN-GEAR BRAKES

44. The main-gear wheels are fitted with hydraulic disc-type brake units. A central brake fluid reservoir is installed on the forward side of the engine firewall. Hydraulic lines connect the wheel cylinders to cylinders mounted individually on each rudder pedal. The brakes are activated by application of toe pressure on the upper portion of the rudder pedals. The toe brakes may be used to assist in steering the aircraft on the ground.

NOSE-WHEEL STEERING

45. Steering is accomplished by the use of rudder pedals through a spring-loaded linkage connecting the nose gear to the rudder pedals. The nose gear maximum travel is 40° $\pm$ 2° right

or left, and a hydraulic shimmy damper on the nose-gear yoke compensates for any tendency to shimmy.

CAUTION

- Do not attempt to turn the nose wheel by rudder-pedal pressure, unless the aircraft is in motion. Excessive pressure over a period of time may elongate the taper pin holes where the steering arm attaches to the rudder-pedal torque shaft.
- The travel-stop bolt at the top of the nose-wheel strut may be sheared while towing the aircraft if the above limits are exceeded. Red lines are painted on the nose-wheel fairing to indicate maximum travel of the nose wheel.

PARKING BRAKES

46. A parking brake handle is provided below the PITOT switch on the lower left sub-panel (see Figure 1-6). It is activated by pulling the handle out and pumping up the pressure using the toe brakes. The parking brake is released by pushing the handle in until it is flush with the panel.

NOTE - The parking brake should be left off and wheel chocks should be installed if the aircraft is to be left unattended. Changes in ambient temperature could cause release of the brakes or exert excessive pressures.

HEATING, DEFROSTING, AND VENTILATION SYSTEM

COCKPIT HEATING AND DEFROSTING

47. Air for cockpit heating and defrosting is inducted from two sources (see Figure 1-1); fresh air is drawn into the right air intake on the front of the engine cowling and passed through a duct to a heating muff installed around a portion of the engine exhaust manifold. It is heated and passed to the rear of the engine to a mixing chamber where it can be mixed with fresh unheated air, which is drawn into an intake on the right side of the engine cowling. A butterfly-type valve in the mixing chamber is controlled by the CABIN HEAT control on the throttle quadrant. Control is infinitely variable from 100 per cent heated air to 100 per cent fresh air. Heated air for defrosting the windshield is drawn from the heated-air duct and then passed through deflecting nozzles to each half of the windshield. A gate valve is employed to close off the defrosting duct or to vary the volume of heated air; it is controlled by the DEFROST control mounted on the throttle quadrant (flush in - off, full out - ON). To alleviate pressure build-up in the heated-air duct when CABIN HEAT and DEFROST controls are closed off, a valve vents to the engine compartment. Another gate valve in the common duct is controlled by the CABIN AIR volume control on the throttle quadrant; it controls the volume of air entering the cockpit through outlets on either side of the centre pedestal and outlets for the rear-seat passengers. For system, see Figure 1-8; for controls, see Figure 1-6.

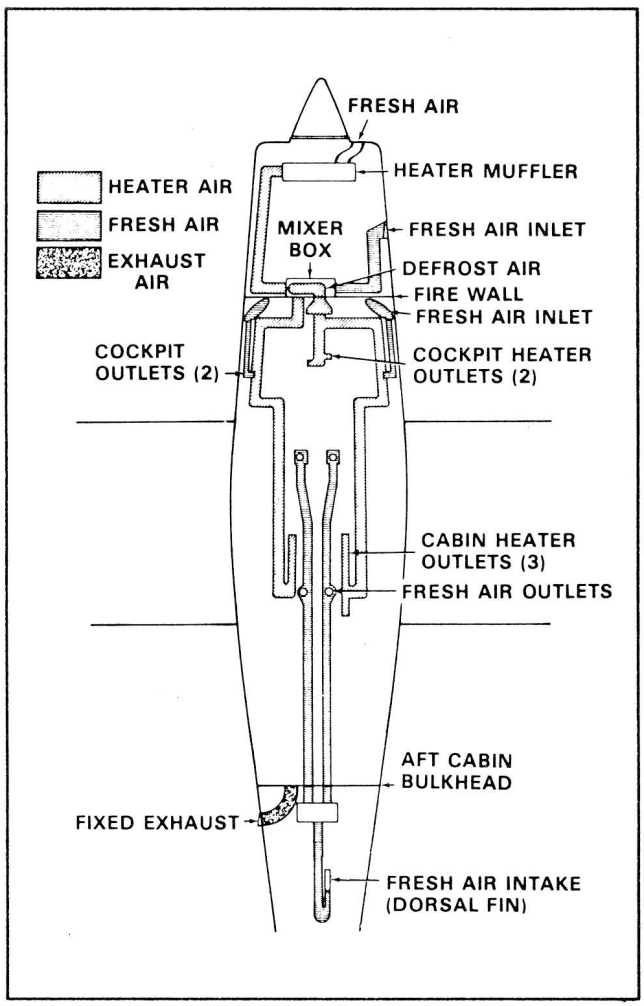


Figure 1-8 Heating, Defrosting, and Ventilation System

COCKPIT VENTILATION

48. As noted in paragraph 47, fresh, unheated air may be drawn into the cockpit by leaving the CABIN HEAT control lever closed (flush against the engine control quadrant), and leaving the CABIN AIR volume lever pushed in (flush against the engine control quadrant). The volume of air is reduced as the CABIN AIR volume lever is pulled out. Additional fresh air for the cabin enters through two grill-type intakes immediately forward of the windshield and through a scoop-type intake on the dorsal fin. The grill-type intakes supply fresh air to the outlets on each side of the instrument panel. The scoop-type intake supplies fresh air to the four overhead outlets. Air flow through the outlets is regulated by rotating the outlet.

INSTRUMENTS

GENERAL

49. The instruments are installed in a shock-mounted instrument panel (see Figure 1-6). The flight instruments are located in front of the left cockpit seat in a standard T-shaped layout, with the magnetic compass and outside-air temperature gauge located above the instrument panel. The engine instruments are located on the instrument panel directly above the throttle quadrant.

FLIGHT INSTRUMENTS

50. Flight instruments include the following:

a. Airspeed indicator.

b. Attitude indicator.

c. Altimeter.

d. Accelerometer.

e. Turn-and-slip indicator.

f. Main compass system.

g. Vertical-speed indicator.

h. Eight-day clock.

NOTE - The clock is susceptible to jamming due to over-winding. Aircrew are not to wind the clock routinely during cockpit checks. Servicing crews, on a daily basis, will ensure that the clocks are properly wound.

j. Outside-air temperature gauge.

k. Standby Magnetic Compass.

ENGINE INSTRUMENTS

51. Engine instruments include the following:

a. Engine tachometer and engine running-time counter.

b. Fuel pressure gauge.

c. Fuel quantity gauges.

d. Oil temperature gauge.

e. Oil pressure gauge.

f. Ammeter.

g. Suction gauge.

h. Cylinder-heat-temperature gauge.

j. Carburettor-air-temperature gauge.

PITOT-STATIC SYSTEM

52. The pitot-static system is conventional, with the pitot tube located under the leading edge of the left wing tip (see Figure 1-1). There are two static sources, located on either side of the fuselage, midway between the wing and the stabilator (see Figure 1-1).

PITOT-STATIC-OPERATED FLIGHT INSTRUMENTS

53. Pitot-static-operated flight instruments are:

a. Airspeed indicator.

b. Altimeter.

c. Vertical-speed indicator.

VACUUM-OPERATED FLIGHT INSTRUMENTS

54. The vacuum-operated flight instruments are the attitude indicator and the main compass system. These instruments are gyro-stabilized and self-erecting, provided that sufficient suction is available to maintain the vacuum.

NOTE - After normal suction is attained, two to three minutes may be required for the main compass and attitude indicator to reach full operating speeds. During this period erroneous indications may be evident.

55. Although the main compass system is vacuum driven, it is electrically controlled when the mode switch is selected to the SLAVE No. 1 or SLAVE No. 2 position (Figure 1-6). In either position the SLAVING OFF flag disappears and the compass is electronically controlled. With the mode switch selected to the FREE position, the compass operates as a free directional gyro. Incorporated in the compass is a manually controlled heading bug.

NOTE - When operated in the SLAVE No. 1 or No. 2 position the annunciator will fluctuate indicating proper function of the slaved gyro. Should the SLAVE OFF flag appear while in SLAVE No. 1 position, select the No. 2 position. If the SLAVE OFF flag does not disappear, the main compass system should be operated as a directional gyro with the mode switch selected to the FREE position.

ELECTRICALLY-OPERATED FLIGHT INSTRUMENTS

56. Only the rate-of-turn pointer of the turn-and-slip indicator is an electrically powered gyro flight instrument.

INTERIOR AND EXTERIOR LIGHTING

GENERAL

57. The aircraft lighting system provides illumination for the aircraft interior and exterior as follows:

a. **Interior Lighting** - Instrument panel lights and an instrument panel flood-light. A cabin dome light is also provided for use, principally, on the ground.

b. **Exterior Lighting** - Landing lights, navigation lights and strobe lights.

INTERIOR LIGHTING

58. The engine instruments, magnetic compass and navigation/communication transceiver are individually and internally lit. The airspeed indicator, attitude indicator, altimeter, main compass, turn-and-slip indicator, vertical-speed indicator, clock and cylinder-head temperature gauge are illuminated externally by post lights. The fuel selector is illuminated by a small light under the dash. All these lights are controlled by a rheostat on the lower sub-panel to the left of the throttle quadrant labelled POST & PANEL. There is a flood-light mounted in the centre of the cockpit roof, which is used to illuminate the instrument panel in the event the instrument lights fail. It is controlled by a rheostat located to the right of the POST & PANEL rheostat and labelled OVRHD.

NAVIGATION LIGHTS

59. Conventional navigation lights are provided at the right wing tip (green), top rudder tip (white), and left wing tip (red). Wing strobe lights are co-located with the green and red navigation lights, and a rotating beacon is mounted on top of the fin (see Figure 1-1).

LANDING LIGHTS

60. The landing lights are located on the underside of the leading edge of the left wing and the right wing, approximately 8 inches inboard of the wing tip (see Figure 1-1). They are faired into the wing by means of plexiglass covers which are flush with the wing surface. They are controlled by a two-position switch, marked LANDING, and ON, located on the lower sub-panel (see Figure 1-6).

COCKPIT EQUIPMENT

SEAT AND HARNESS

61. Individual bucket-type seats are provided at each seating position in the cockpit (see Figure 1-7). The two forward seats are mounted on rails which permit them to be adjusted fore and aft when a lever, located on the front of each seat, is moved to the right and raised. The rake of the forward seat backs is adjustable to three positions when a lever, located on the inside of each seat, is raised. Two jacks are attached to the overhead panel into which helmets or headsets may be plugged. Each of the front seats is provided with a shoulder harness, attached to an inertia reel. The shoulder harness is connected to the conventional lap belt by means of slotted steel fittings through which the lap-belt buckles are inserted prior to fastening (see Figure 1-9). Lap belts only are provided for the rear seats.

DOORS

62. Two cockpit doors are installed, one on either side. Each door is provided with a normal latch and locking-pin arrangement. The latches are actuated internally by normal door handles, which are spring-loaded to the closed position.

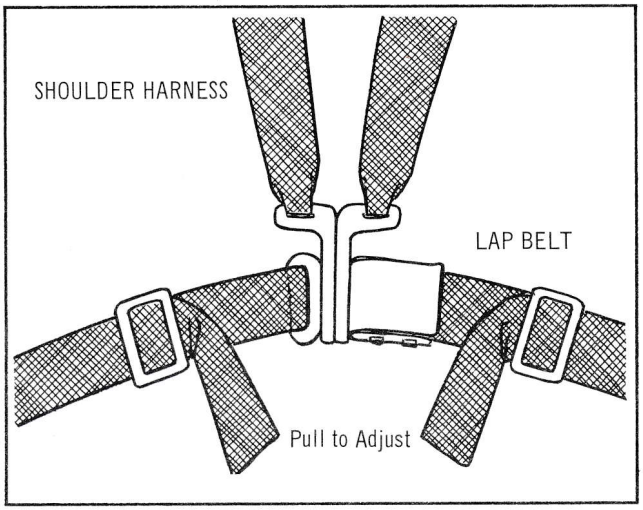
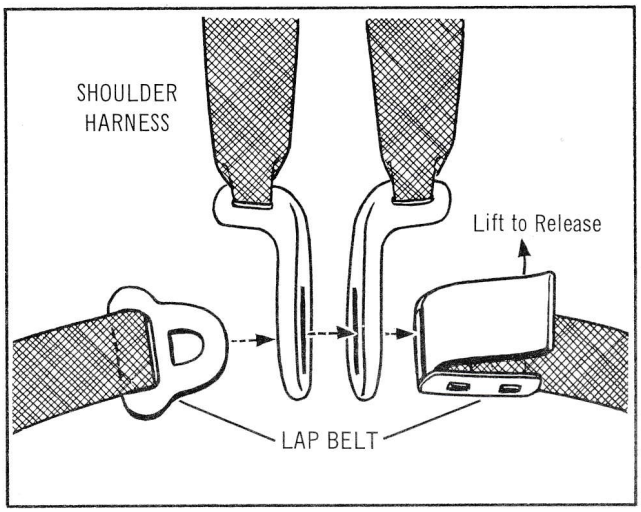


Figure 1-9 Safety Harness



CAUTION

To preclude damage to the door hinges, do not use the securing arms during start-up or taxi.

The door handles on the exterior of the aircraft are flush-mounted. To operate, the handles are pulled out and to the rear. The locking pins are inserted into the door frame at the top rear and the lower side of each door opening. To secure the cockpit doors for flight from inside the aircraft, a handle in the lower forward section of each door is rotated upward so as to be in the vertical position when locked.

NOTE - During the walkaround, ensure that the door pins are free (to preclude damage to the door frames when the doors are closed).

63. The doors may be locked from the outside with a key when the aircraft is left unattended. A quick-release mechanism is also provided for each door. This mechanism, when actuated, withdraws the hinge pins from the external door hinge allowing the door to fall away from the aircraft. The quick-release handles are lock-wired with soft wire which is sheared when the handles are operated. The upper external door hinge is similarly wired. The quick-release handles are not normally used, but may be used when exiting the aircraft if the doors are jammed and cannot be operated in the normal fashion. Each door is also provided with a folding brace, which holds the door in the opened position for ease of entry and exit. In addition, the doors are fitted with door-securing arms, which permit them to be left partially open during very hot weather to ventilate the cockpit while the aircraft is parked on the flight line. A cockpit door is illustrated in Figure 1-10.

64. To effect an emergency door-opening after the normal procedure has failed, rotate the red handle forward (Figure 1-10) and push the door out. For best effect, force your shoulder against the centre of the door.

65. An additional door, located on the lower left fuselage to the rear of the left wing, provides access to the baggage compartment. This door may be locked with the same key used for the cockpit doors.

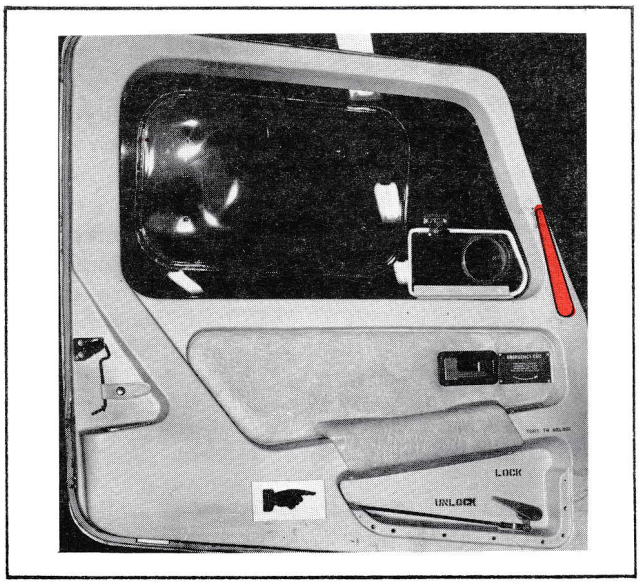


Figure 1-10 Cockpit Door

FIRE EXTINGUISHER

66. A hand-operated 7.5-pound fire extinguisher, filled with bromo trifluoromethane is mounted in a bracket ahead of the rear seat, on the spar cover (Figure 1-7). Although the filling is rated low on the scale of toxicity and noxiousness, ventilate the cabin after using the fire extinguisher.

FIRST-AID KIT

67. A first-aid kit is located on the cockpit floor beside the fire extinguisher.

MAP CASE

68. Pockets are provided on the back of each front seat and on each front door. Emergency instructions and maps are located in the map-pouch behind the right front seat. A signalling kit is located in the pocket on the back of the left seat. This kit contains flares, a mirror, and a PRQ 501 emergency radio.

SUPPLEMENTARY SURVIVAL KIT

69. An emergency supplementary survival kit is located in the baggage compartment. It is released by pulling upwards on the red tab. This kit contains two sets of head-, hand-, and foot-wear, a panel marker, and half of a parachute canopy for use in constructing an emergency shelter.

AVIONIC EQUIPMENT

GENERAL

70. The aircraft is equipped with a KR 87 Automatic Direction Finder (ADF), a KY 196 VHF transceiver, a KT 76A transponder, and a KN 53 Navigation Receiver which incorporates VOR and ILS. This equipment is controlled and monitored through an intercommunications system which incorporates a KMA 24H selector panel and an AVIONICS MASTER switch, an INTERCOM SYSTEM switch, and a STANDBY PHONE position switch.

INTERCOMMUNICATIONS SYSTEM

71. **General** - The intercom system is located on the NAV/COMM panel on the upper right side of the instrument panel (see Figure 1-6). It houses three two-position toggle switches and a selector panel which act as a switchboard for the entire avionic complement. The three toggle switches are labelled and operated as shown in the following paragraphs.

72. **AVIONICS MASTER** - The first switch on the left is labelled AVIONICS MASTER and acts as a power on/off switch for the entire avionic complement; up for ON and down for off.

73. **INTERCOM SYSTEM** - The second switch from the left is labelled INTERCOM SYSTEM. When selected to the up position (HOT MIC), intercommunication between the pilots is continuous without further adjustment or selection of the avionics. With the intercom switch off (down), the HOT MIC is deactivated and the external transmit function is inoperative, even though the rotary MIC SELECT switch on the audio control panel is selected to COM 1. (The yoke XMIT switch will operate as an intercom switch.) External audio can be monitored, provided that the appropriate lower row (phone) buttons are depressed on the selector panel.

74. **STANDBY PHONE** - The third switch from the left is labelled STANDBY PHONE and is used in the event of a selector panel audio failure.

75. In the event of a selector panel audio failure, the STANDBY PHONE switch may be selected ON (up) to bypass the normal audio panel amplifier. The function of the AVIONICS MASTER switch and the INTERCOM SYSTEM switch remains the same, except that the HOT MIC capability and the audio-control panel volume-switch are inoperative. To regain intercom, the rotary MIC SELECT switch can be selected to either PA or EXT and the yoke XMIT switches will provide normal intercom. In the standby phone mode, the upper row (speaker) buttons control the input to the audio system as per normal operation (including AUTO selection).

76. To transmit on COM 1, the INTERCOM SYSTEM switch must be ON (up), and the rotary MIC SELECT switch in the COM 1 position.

77. When transmitting in the standby phone mode, there is no transmit sidetone; however, the T-light will illuminate on the COM 1 face panel.

78. If total power is lost to the avionics system, ie, failure of the AVIONICS MASTER switch, check the circuit breakers. If the fault cannot be isolated, attempt to regain power to the avionics system by pulling the SLAVED GYRO circuit breaker.

CAUTION

If the SLAVED GYRO circuit breaker is pulled, the magnetic correction inputs to the RMI will be disconnected, a warning flag will appear in the RMI, and the RMI will operate as a directional gyro only.

79. If power is regained to the avionics by pulling the SLAVED GYRO circuit breaker, the avionics system will function according to its normal operation, as previously described.

80. **Mute Switches** - Also incorporated in the intercom system are three mute switches: Station 1 (pilot) and Station 2 (co-pilot) located on the control yokes, and Station 3 located on the centre of the instrument panel. These switches will mute all incoming signals (COM 1, NAV 1, ADF etc), but the hot mic will remain on.

AUDIO SELECTOR PANEL

81. The KMA 24H audio selector panel incorporates a volume control (INT/VOL), two rows of push buttons and a rotary MIC SELECT switch. The volume control affects the volume of the intercom only; it does not affect the volume of the audio inputs selected with the push buttons. Desired radios (COM 1, NAV 1, ADF) can be monitored by depressing the appropriate button on the lower row of buttons (phone) on the audio control panel. By depressing the lower row AUTO button on the audio control panel, both transmit and receiver functions are controlled by the rotary MIC SELECT switch on the right side of the audio control panel. This ensures that the receiver is automatically selected to the headset even if the COM 1 button is not depressed on the audio control panel. The rotary MIC SELECT switch is labelled OFF, TEL, COM 1, COM 2, PA and EXT. When the system is operated normally (HOT MIC ON) only the COM 1 position is active. Station 1 (pilot) or Station 2 (co-pilot) transmit switches will transmit on COM 1 provided the intercom system switch is ON and the rotary MIC SELECT switch on the audio control panel is selected to COM 1. When transmitting, a T-light will illuminate on the COM 1 lower centre face panel. Station 2 (co-pilot) transmit switch will override Station 1. During STANDBY PHONE operation, the rotary MIC SELECT switch is selected to either PA or EXT and these positions become active and provide normal intercom by use of the yoke XMIT switches. The TEL and COM 2 positions are inactive in this installation.

ADF RECEIVER

82. The ADF is located on the NAV/COMM panel directly below the intercom system. The system consists of a KR 87 receiver, a K 1227 ADF indicator and a blade antenna located on the underside of the fuselage beneath the pilot position. The receiver handles reception in the low and medium frequency bands from 200 to 1799 kHz. Relative bearing to the station is displayed on the ADF indicator which has a rotatable azimuth indicator (see Figure 1-6). Operation of the system is as shown in the following paragraphs (refer to Figure 1-11).

83. **On/OFF/VOL** - This control turns on the set and controls the volume. The ADF has 'audio muting' which causes the audio to be muted until the set is locked on to a valid station.

84. **Antenna Mode** - The antenna mode is selected and lit up when the ADF button is in the out position. The antenna mode provides audio reception only; the bearing pointer of the indicator immediately turns to 90° and remains there during the antenna mode.

85. **ADF Mode** - The ADF mode is selected and lit up when the ADF button is depressed. This activates the bearing pointer in the indicator, causing it to point in the direction of the station relative to the aircraft heading. The BFO mode is selected and lit up when the BFO button is depressed, permitting the carrier wave and morse code identifier to be heard.

86. **Frequency Selection** - The active or in-USE frequency is displayed in the left side of the window at all times. A standby frequency is displayed in the right side when FRQ is lit up. The standby frequency is selected using the frequency select knobs on the right of the set. They may be rotated either clockwise or counter-clockwise. Pull out the small inner knob to tune the 1s. Push it in to tune the 10s. The outer knob tunes the 100s and 1000s up to 1799. The active and standby frequencies may be switched about by pressing the FRQ button. The standby frequency is placed in 'blind' memory if either FLT or ET mode is selected. When in this condition, the frequency selectors control active frequency. The exception to this is when the ET message is flashing.

ADF TIMER FUNCTIONS

87. **FLT/ET Button** - If elapsed time (ET) is currently displayed, pressing the FLT/ET button will cause the flight timer to be displayed. Pressing this button again will exchange the two

timers in the display. If the standby frequency is displayed, pressing the FLT/ET button will cause the timer which was last displayed to reappear in the window.

NOTE - When power is first applied, the flight timer is displayed.

88. **Flight Timer** - The flight timer is displayed in the right-hand window when the FLT message is lit. This timer will count up to 59 hours, 59 minutes, 59 seconds. When the unit is first turned on, this timer is automatically started at 0. Minutes and seconds will be displayed until a value of 59 minutes and 59 seconds is reached. On the next count, the display will shift to hours and minutes. The flight timer is reset to 0 only when the unit is turned off.

89. **Elapsed Time** - This timer has two modes; count-up and count-down. When power is applied, it is in the count-up mode starting at 0. As with the flight timer, the elapsed timer will count to 59 hours, 59 minutes, 59 seconds, displaying minutes and seconds until 1 hour has elapsed, then displaying hours and minutes. When in the count-up mode, the timer may be reset to 0 by pressing the RESET button.

NOTE - Pressing the RESET button will reset the elapsed timer, regardless of what is currently being displayed.

90. To enter the count-down mode, the RESET button is held depressed for approximately 2 seconds until the ET message begins to flash. (This may be done regardless of the current display.) While the ET message is flashing, the timer is in the ET-set mode. In this mode a number up to 59 minutes, 59 seconds may be preset into the elapsed time with the concentric knobs. With the small knob pressed in, the 10s-of-seconds digit may be changed. It will roll over from 5 to 0 and under from 0 to 5. With the knob pulled out, the 1s-of-seconds digit may be changed. It rolls over from 9 to 0 and under from 0 to 9. The large knob modifies the minutes. It rolls over from 59 to 0 and under from 0 to 59. The timer will remain in the ET set mode (ET message flashing) for 15 seconds after a number is set in or until the RESET, FLT/ET, or FRQ button is pressed. The number preset will remain unchanged until the RESET button is pressed. When the RESET button is pressed after a number is preset, the elapsed timer will start counting down.

NOTE - The timer will start when RESET is pressed, regardless of the current display.

91. When the timer reaches 0, it changes to the count-up mode and continues up from 0; also, the right-hand display will flash for 15 seconds. While the elapsed timer is counting down, pressing the RESET button will have no effect unless it is held for approximately 2 seconds. This will cause the timer to stop and enter the set mode (ET message flashing).

TRANSPONDER

92. The KT 76A transponder is located on the NAV/COMM panel directly below the ADF receiver. Its small blade antenna is located under the fuselage beneath the co-pilot position. Operation of the transponder is shown in the following paragraphs (refer to Figure 1-11).

93. The transponder is turned on by rotating the function selector from the OFF position to any other position.

94. After being turned on, there is a 45-second delay before the unit becomes functional. This is to permit the transmitter tube to warm up and stabilize. Usually the function switch will be rotated to the standby (STBY) position; however, any operative position will initiate the time-delay turn on. Any time that the function switch is in the ON or ALT position, the transponder becomes an active part of the beacon system. Do not operate with the function selector in either of these positions while on the ground, taxiing, or running up at a terminal with a co-located beacon interrogator. Pay attention to the code selected on the control head. The selected code should be in accordance with instructions for IFR flight or rules applicable to transponder utilization for VFR flight.

95. During normal transponder operation, a flashing lamp is an indication of a transmitted reply. An interrogation will normally be at 10- to 15-second intervals. Lamp flashes within this interval may be from noise, a second or third interrogator, or from side lobes from interrogators without side-lobe suppression.

96. The ON function will be the customary mode of operation.

NOTE - ALT function enables the transponder to encode an altitude reply. The Musketeer II does not have this capability.

97. The IDENT feature is used at the request of the traffic controller. The IDENT button is depressed momentarily and then released. A memory holds the IDENT reply for an interval to

assure the proper reply for at least one radar sweep. This memory also turns the reply lamp on as an indication of the IDENT function.

98. Appropriate codes are set by using the code selector knobs.

99. To self-test the transponder, turn the selector to the spring-loaded TST position for a few seconds. The reply light will blink, indicating the transponder is operating.

NAVIGATION RECEIVER

100. The KN 53 navigation receiver consists of the control head, located on the nav/comm panel below the KY 196 VHF; the diplexor, located behind the control head; the antennae, located on the upper portion of the rudder; and a KI 204 navigation indicator, located on the pilot's instrument panel. The indicator will display ILS information (front or back course) when an ILS frequency is set into the left window of the receiver, or VOR radials when a VOR frequency is set into the left window of the navigation receiver. Through the use of a diplexor, ILS glide slope and localizer information is obtained from the VOR antenna. Operating procedures for the navigation receiver are shown in the following paragraphs. (See Figure 1-11.)

101. The unit is turned on by rotating the On/OFF/Volume switch clockwise. The power off position is felt by counter-clockwise rotation into a positive switch detent action. The NAV volume output is increased by clockwise rotation of the On/OFF/Volume switch. Voice nav information is heard when the On/OFF/Volume switch is pushed in. When the On/OFF/Volume switch is pulled out, the IDENT signal, plus voice information, may be heard.

102. The outer frequency control knob is the MHz select, and moves clockwise or counter-clockwise in one MHz step. The inner frequency control knob is the kHz select and moves clockwise or counter-clockwise in 50 kHz steps.

103. To increase frequency, rotate knobs clockwise; to decrease frequency, rotate knobs counter-clockwise. Moving either frequency control knob will only upate the standby (STBY) displayed frequency. Internal glide slope and ILS channelling are also performed by this control.

104. The STBY frequency can be moved to the USE (active) frequency by momentarily depressing the frequency transfer button (ie, when the frequency transfer switch is energized, the USE frequency and STBY frequency trade places).

VHF RADIO

105. The KY 196 VHF transceiver is located on the nav/comm panel directly below the KT 76A transponder. It consists of the transceiver and a pole antenna located on top of the fuselage above the pilot. The transceiver operates within a frequency of 118 MHz to 135 MHz. Operating procedures for the transceiver are shown in the following paragraphs (refer to Figure 1-8).

106. Rotate the volume knob clockwise from the OFF position. Pull the volume knob out to override the automatic squelch and rotate it for desired listening level on the noise being produced by the receiver. Push the volume knob back in to activate the automatic squelch.

107. Select the desired operating frequency in the STBY display by rotating the increment/decrement knobs either clockwise or counter-clockwise. A clockwise rotation will increase the previous frequency, while a counter-clockwise rotation will decrease the previous frequency. The larger inside knob will change the MHz portion of the STBY display. At one band-edge (118 or 135 MHz), the following MHz change will wrap around to the other band-edge. The smaller outside knob will change the kHz portion of the STBY display. It will change in steps of 50 kHz when the knob is pushed in, and 25 kHz when the knob is pulled out. The wrap-around band-edge is also utilized when increasing or decreasing the kHz portion of the STBY display.

108. To tune the radio to the desired operating frequency, the desired frequency must first be entered into the STBY display, and then the transfer button must be pushed. This will trade the contents of the active and the standby display. The transceiver is always tuned to the frequency appearing in the active display. It is therefore possible to have two different frequencies stored in the USE and STBY displays and to change back and forth between them by pushing the transfer button.

109. During the transmit operation, a T-light will appear between the USE and STBY displays, signifying that the transceiver is in the transmit mode of operation.

NOTE - The volume control of the VHF transceiver is extremely sensitive. To ensure that proper volume for initial use and following frequency changes, the procedure in para 106 should be used to set the proper receiver volume.

PANEL LIGHTING

110. The light emitting diodes (LEDs) on the navigation receiver, the VHF transceiver, and the ADF will automatically dim and brighten to compensate for changes in ambient light level. The dimming is controlled by a photocell mounted behind the front panel lens to the left of the display. The remainder of the lights of the nav/comm panel are controlled by the POST & PANEL rheostat.

DOWNED-AIRCRAFT LOCATOR BEACON

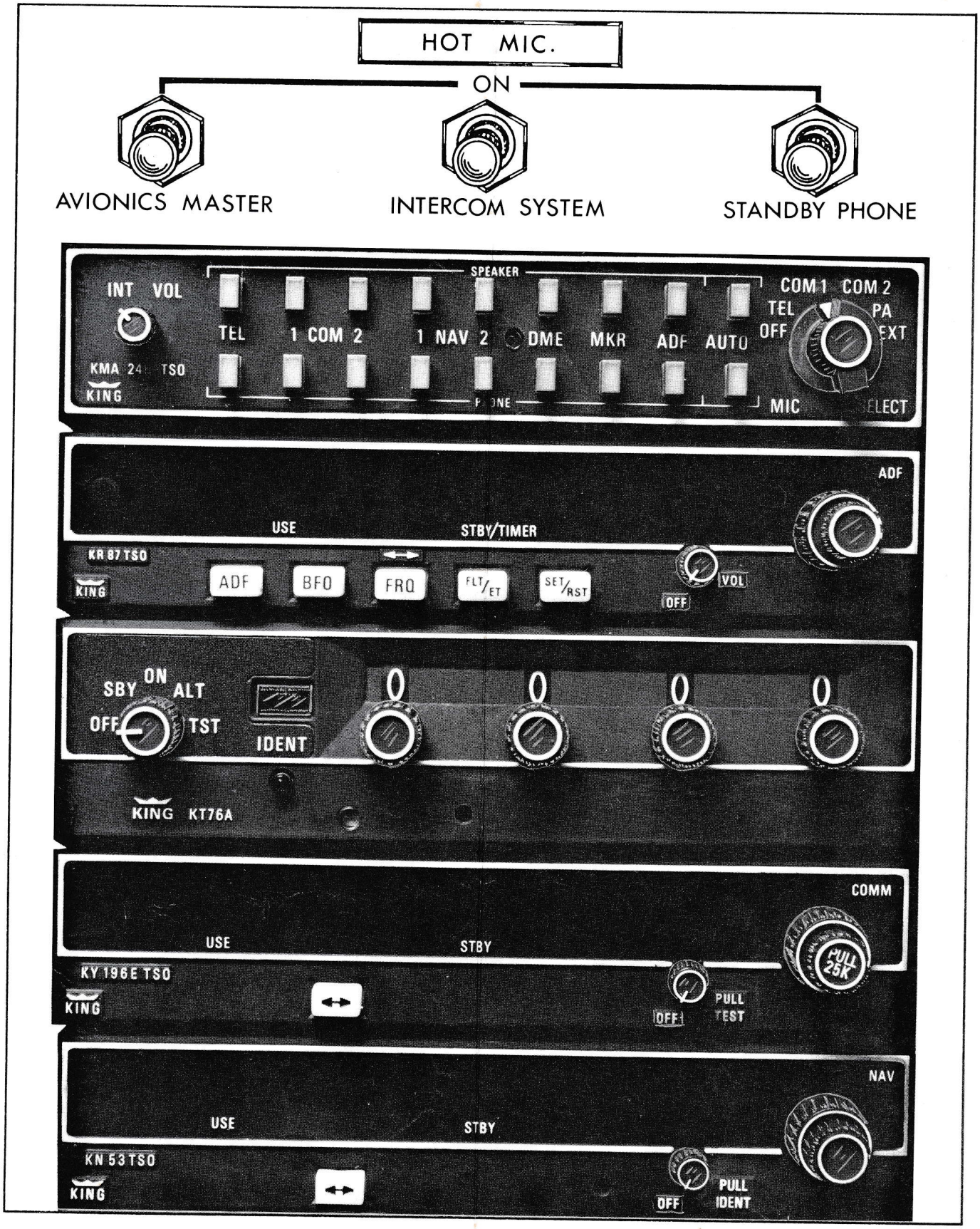
111. The downed-aircraft locator (DAL) is a three-part unit. It consists of a transmitter, mounted on the left rear side of the fuselage, a control/charger panel on the right-hand instrument panel, and antennae on either side of the vertical fin at the rear of the aircraft. Transmission is effective on both 121.5 MHz and 243.0 MHz, with an operation time of 24 hours at -40°C, and up to 96 hours at temperatures above -30°C.

Transmission on both 121.5 MHz and 243.0 MHz will be maintained for at least 30 hrs. at -40°C. or 36 hrs. at -20°C.

112. Activation will be automatic on a 5 G forward deceleration, but manual activation is also possible, either by selecting START on the outside transmitter panel switch or by selecting TX ON with the guarded switch on the control/charger panel. Only if activated from the control/charger panel may the unit be switched off at this point. If automatically or externally activated, the unit must be switched off at the outside transmitter panel.

113. On the control/charger panel, the red transmit light will illuminate any time the DAL has been activated. The yellow light will illuminate if insufficient charge is being supplied to the DAL battery. If the yellow light remains on for a period in excess of 1 hour, suspect the DAL battery-charging system to be unserviceable and make an appropriate major unserviceability entry on Aircraft Maintenance Report, form CF 349.

NOTE - A TEST switch is provided on the panel for use by groundcrew. Operation of TEST switch may cause accidental activation of the set.



Avionics Equipment Figure 1-11

PART 2

NORMAL OPERATING PROCEDURES

PRE-FLIGHT

BEFORE ENTERING THE COCKPIT

1. Check the Aircraft Maintenance Record Set for engineering status, and ensure that the aircraft has been properly serviced.

2. Carry out pre-external and external checks as detailed in Figure 2-1.

PRE-START CHECK

3. After entering the cockpit, complete the following checks and actions:

a. Door-securing arm - Fastened down with strap.

b. Seat - Adjust.

c. Harness - Fasten.

d. Parking brake - Set.

e. Control movement -

Aileron - Check. For full travel and smooth and proper operation.
Stabilator - Check. For full travel and smooth and proper operation.
Rudder - See Part 1, paragraph 45, CAUTION.

f. Fuel selector - Set to R TANK.

g. THROTTLE - Closed; then cracked.

h. MIXTURE control - Rich and in detent.

j. CARB HEAT control - Cold.

k. COWL FLAP - Check open (to allow access to engine compartment in case of fire).

m. Fireguard - Standing by.

n. External power - Connected (if used).

p. Switches -

BTY - ON.
ROTATING BEACON - ON.

q. Doors - Closed.

START PROCEDURES

4. The engine may be started using the aircraft battery or an external power sources. To start the engine, proceed as follows:

a. FUEL BOOST - No. 1 ON.

b. ENGINE PRIMER - 2 to 10 strokes, depending on OAT and engine temperature from previous flight.

c. 'All Clear'.

d. Magneto/START switch - To START. STARTER ENGAGED light - ON.

CAUTION

If light fails to illuminate, monitor ammeter to ensure that the indication is less than 25% of full charge at 1000 and 1200 RPM within 2 minutes.

e. OIL PRESS gauge - Check for indication within 30 seconds; if no pressure, shut down and report aircraft unserviceable.

f. STARTED ENGAGED light - OFF.

CAUTION

If light remains illuminated on ground:

BTY switch and ALT switch - OFF.

Shut down aircraft.

g. External power - Disconnected (if used).

h. Chocks - Removed.

j. ALT switch - ON.

k. GYRO - SLAVE 1.

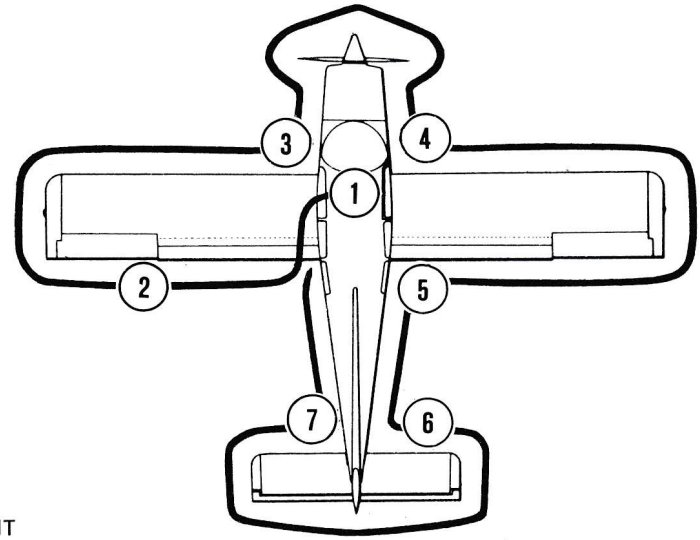
m. THROTTLE - 1000 to 1200 RPM for warm-up.

n. AVIONICS MASTER - ON.

p. Radios - ON as required.

1 PRE-EXTERNAL CHECK

a.	Cowl Flap	CHECK CLOSED
b.	Pitot Head Cover	REMOVED
c.	Accelerometer	IN LIMITS
d.	Controls	UNLOCKED
e.	Switches –	
	Magneto/START	OFF
	Lights	As required
	Battery (BTY)	ON – Check fuel quantity then off if not required
	ALTernator	OFF
	FUEL BOOST pumps	OFF
f.	COWL FLAP	OPEN
g.	AVIONICS MASTER	OFF
h.	Loose Articles	STOWED
j.	Fire Extinguisher & First-Aid Kit	SECURITY & CONDITION
k.	Signal Kit	CHECK Left Seat Pocket
m.	Forced Landing Instruction	CHECK Right Seat Pocket
n.	Supplementary Survival Kit	IN PLACE & SECURE IN BAGGAGE COMPARTMENT
p.	Emergency Door Handles	WITNESS-WIRED
q.	Door Pins	FREE MOVEMENT



2 LEFT WING

a.	Flap	CONDITION & SECURITY (actuator arm, hinge arms, screw stop and outboard hinge)
b.	Aileron	SECURITY, CONDITION & CLEARANCE
c.	Upper Wing Surface	CONDITION
d.	Wing Tip	CONDITION
e.	Nav Light/Wing-Tip Strobe	CONDITION
f.	Pitot Head	CONDITION
g.	Landing Light	CONDITION
h.	Leading Edge	CONDITION
j.	Stall-Warning Vane	CONDITION, freedom of movement
k.	Lower Wing Surface	CONDITION
m.	Landing Gear	
	Left Main Wheel Chock	IN PLACE
	Brake Line	CONDITION
	Brake Disc	CONDITION
	Knee-Joint Retaining Pin	SECURITY & CONDITION
	Axle Retaining Pin	SECURITY
	Tire	CONDITION (wear, creep, inflation, dust cover secure (if installed))
n.	Fuel Sump Drain	SECURITY (no leaks)
p.	Fuel Cap	SECURITY
q.	Cockpit Vent/Drain	CLEAR
r.	ADF Antenna	SECURITY

3 FUSELAGE – FRONT

a.	Left Door Hinge	SECURITY & HINGE PINS SEATED
b.	Cowling (Left Side)	SECURITY
c.	Spinner	CONDITION (no cracks)
d.	Propeller	CONDITION (nicks, feather-filed, no cracks)
e.	Fuel and Oil	CHECK FOR LEAKS
f.	Nose Wheel –	
	Knee-Joint Retaining Pin	SECURITY
	Axle Retaining Pin	SECURITY
	Tire	CONDITION (wear, creep, inflation, dust cover secure (if installed))
g.	Air Intakes	CLEAR & CONDITION SECURE OIL COOLER, COVER (if installed)
h.	Cowl Flap	CHECK OPEN
j.	Cowling (Right Side)	SECURITY
k.	Cabin Air Intake	CLEAR
m.	Oil Filter Access Cover	SECURITY
n.	Engine Drains & Vents	CLEAR & CONDITION
p.	Fuel Strainer Drain	SECURITY
q.	Right Door Hinge	SECURITY & HINGE PINS SEATED

Figure 2-1 (Sheet 1 of 2) Exterior Inspection Diagram

4 RIGHT WING

a.	Fuel Sump Drain (Right)	SECURITY (no leaks)
b.	Landing Gear –	
	Right Main Wheel Chock	IN PLACE
	Brake Line	CONDITION
	Brake Disc	CONDITION
	Knee-Joint Retaining Pin	SECURITY
	Axle Retaining Pin	SECURITY
	Tire	CONDITION (wear, creep inflation, dust cover secure (if installed))
c.	Cockpit Vent/Drain	CLEAR
d.	Fuel Cap	SECURITY
e.	Lower Wing Surface	CONDITION
f.	Leading Edge	CONDITION
g.	Landing Light	CONDITION
h.	Wing Tip	CONDITION
j.	Nav Light/Wing-Tip Strobe	CONDITION
k.	Upper-Surface Wing	CONDITION
m.	Aileron	SECURITY, CONDITION & CLEARANCE
n.	Aileron Trim Tab	SECURITY
p.	Flap	CONDITION & SECURITY (actuator arm, hinge arms, screw top and outboard hinge)
q.	Transponder Antenna	SECURE

5 FUSELAGE RIGHT SIDE

a.	Battery Vent & Drain	CLEAR & CONDITION
b.	Static Vent	CLEAR
c.	Fuselage	CONDITION
d.	VHF Antenna	CONDITION & SECURITY
e.	VOR/ILS Antenna	CONDITION & SECURITY
f.	Rotating Beacon	CONDITION

6 TAIL SECTION

a.	Stabilator Surface & Tip	CONDITION & SECURITY (freedom and/or excess play)
b.	Stabilator Trim	CONDITION & SECURITY (¼" maximum freedom of movement)
c.	Navigation Light	CONDITION
d.	Vertical Fin	CONDITION
e.	Rudder	CONDITION & SECURITY
f.	Rudder Trim Tab	SECURITY
g.	DAL Antennae	CONDITION & SECURITY
h.	Balance Tab Actuator	SECURITY
j.	Rudder Bell Crank	SECURITY
k.	Stabilator Surface & Tip	CONDITION
m.	Ventral Fin	CONDITION & SECURITY

7 FUSELAGE – LEFT SIDE

a.	DAL	CONDITION (switch lock-wired to AUTO)
b.	Fresh Air Intake Drain	SECURITY
c.	Fresh Air Intake	CLEAR
d.	Static Vent	CLEAR
e.	Cabin Air-Exhaust Vent	CLEAR
f.	Baggage Door	SECURITY & CONTENTS
g.	Fuselage	CONDITION

Figure 2-1 (Sheet 2 of 2) Exterior Inspection Diagram

FAILURE TO START

5. If engine fails to start because of over-priming, proceed as follows:

a. Magneto/START switch - Off.

b. THROTTLE - Open wide.

c. Have propeller rotated by hand six complete revolutions in the direction of rotation.

d. Repeat starting procedure, but do not prime.

6. As an alternative method for clearing a flooded engine, if groundcrew is not available to turn the propeller, proceed as follows:

a. MIXTURE CONTROL - To idle cut-off.

b. THROTTLE - Open wide.

c. Engage starter to turn propeller.

d. As engine fires, immediately retard the THROTTLE to idle and select MIXTURE control to full rich.

PRE-TAXI CHECK

7. Before starting to taxi, check:

a. Dome/cabin light - On/off (as required).

b. Stabilator trim - Check for full travel and set for take-off.

c. Flaps - Check for full travel and then RETRACT.

Sub-Panel - Left

d. Magneto/START switch - Check for dead and live magnetos at 800 RPM.

e. THROTTLE - 1000 to 1200 RPM.

f. ENGINE PRIMER - Check in and locked.

g. BTY switch - Check ON.

h. ALT switch - Check ON.

j. FUEL BOOST pump - Select No. 2, check pressure; then select 'off' and check for drop in fuel pressure.

k. COWL FLAP - Set as required.

m. PITOT heat - ON/off (as required).

n. ROTATING BEACON - ON.

n. WING - DELETED - Off.

q. NAV lights - ON/off (as required).

r. LANDING lights - ON/off (as required).

s. POST & PANEL and OVRHD lights - As required.

Throttle Quadrant

t. CABIN AIR control- Set as required.

u. CARB HEAT control - Check for operation - OAT -10°C or below, HOT. *

v. MIXTURE control - Check for RPM drop - reset rich.

w. CABIN HEAT control - Set as required.

x. DEFROST control - Set as required.

Sub-Panel - Right

y. Circuit breakers - Check - All pushed in.

Instrument Panel

z. Airspeed indicator - Check.

aa. Attitude indicator - Check.

ab. Altimeter - Check and set.

ac. Accelerometer - Check.

ad. Turn-and-slip indicator - Check.

ae. Main compass - Set and annunciating.

af. Vertical-speed indicator - Check.

ag. Engine tachometer - Check.

ah. Cylinder-head gauge - Check.

aj. INSTRUMENT AIR - Check.

ak. Clock - Check.

am. FUEL PRESS - Check.

an. Left fuel gauge - Check.

ap. Ammeter - Check.

aq. OiL TEMP gauge - Check.

ar. Oil pressure gauge - Check.

as. Right fuel gauge - Check.

NAV/COMM Panel

at. AVIONICS MASTER - ON.

au. INTERCOM SYSTEM - HOT MIC.

av. STANDBY PHONE - Off.

aw. Intercom panel - As required.

ax. ADF radio - SET.

ay. TRANSPONDER - Set.

az. VHF Radio - On and check 121.5 for DAL tone; check as required.

ba. DAL - TX lights out.

bb. VOR/ILS - Set.

TAXI CHECK

8. The following checks are performed while the aircraft is moving from the tarmac or parking position to the run-up position:

a. Brakes - Check for operation after parking brake released.

b. Nose-wheel steering - Check.

c. Turn-and-slip indicator - Check needle and ball.

d. Main compass - Check for correct operation.

e. Attitude indicator - Check.

f. Navigational aids - Check (as required).

RUN-UP CHECK

9. Proceed as follows:

a. Parking brakes - Set (pump until positive resistance is felt).

b. Throttle - 1000 to 1200 RPM.

c. Fuel Selector - Change to L TANK.

d. Temperatures and pressures - Check - Correct for run-up and oil temperatures off peg.

e. Cowl flap - As required.

f. Area - Check (ensure that run-up will not adversely affect other aircraft, personnel, etc).

g. Throttle and engine RPM - Advance to 2200 RPM.

h. Magnetos - Check (L, BOTH, R, BOTH). Maximum permissible drop - 125 RPM; maximum permissible difference - 50 RPM.

WARNING

If the magnetos are inadvertently selected to OFF and back to ON at high-power settings, serious engine damage may occur. In all such cases, the aircraft will be returned to the ramp and placed unserviceable. If the magnetos are selected OFF and the engine allowed to stop without an ON selection being made, the aircraft may be restarted and the mission continued.

j. Temperatures and pressures - Within operating limits.

k. Suction gauge - Check reading.

m. Carburettor heat control - Above -10°C - Check for carburettor ice. *

n. Ammeter - Check for charging.

p. Throttle and engine RPM - Close throttle and check; slow idle 600 to 700 RPM in summer; 700 to 800 RPM in winter; go back to normal ground idle 1000 to 1200 RPM.

PRE-TAKE-OFF CHECK

10. Check the following before take-off:

H - Harness - Tighten (lap belt).
- Helmets - Chin strap secure.

T - Trim - Set for take-off.
- Temperatures and pressures - Within operating limits.

M - MIXTURE control - Rich.
- CARB HEAT control
  - Above -10°C OAT - COLD.
  - -10°C OAT or below - HOT (Cold when full power attained on 7/0 roll.

F - Fuel selector - L TANK; check fuel quantity both tanks.
- FUEL BOOST pump - No. 1 ON (check pressure rising and stabilized).
- Flaps - Set (as required).
- COWL FLAP - Set as required.

G - Gyros - Set and annunciating.

S - Switches -
Magneto/START - BOTH.
Battery (BTY) - ON.
ALTernator - ON.
PITOT Heat - ON (if required).
ROTATING BEACON - ON.
Wing STROBE lights - ON.
NAV lights - ON/off (as required).
LANDING light - ON/off.

C - Cockpit doors - Locked.

R - Radios - Set (as required).
- Transponder - ON (as required).

IN-FLIGHT PROCEDURES

NORMAL TAKE-OFF

11. Proceed as follows:

a. Line the aircraft up on the runway and allow it to travel sufficiently forward down the runway to ensure that the nose wheel is straight.

b. Smoothly apply full power, advancing the throttle all the way forward. If carburettor heat is in the 'hot' position, smoothly select CARB HEAT 'cold' once full throttle and RPM is attained.

c. As the take-off roll is commenced, maintain a light back pressure on the control yoke. Keep the aircraft straight with nose-wheel steering, or rudder, or brakes, or a combination of any of these.

d. The aircraft will become airborne as the airspeed reaches 70 knots IAS. Allow the aircraft to accelerate to 90 knots IAS in a shallow climb before assuming the climb attitude.

POST-TAKE-OFF CHECK

12. Complete the following actions:

a. Flaps - Retract and check visually.

b. Temperatures and pressures - Check within operating limits.

c. FUEL BOOST pump - ON.

d. CARB HEAT - Cold.

NORMAL CLIMB

13. The recommended climb speed is 90 knots IAS. Although this airspeed will not produce the maximum rate of climb, it permits better visibility with a good rate of climb. Track out on the extended runway centre line.

STRAIGHT-AND-LEVEL FLIGHT

14. Anticipate levelling off from the climb just prior to reaching the desired altitude. The maximum airspeed can be predetermined roughly from the data in Part 4, paragraph 14, and Figure 4-14, and will depend upon the altitude, temperature and power setting used. Normally, straight-and-level flight in the circuit (down-wind) is done at 110 knots IAS.

STALLS

15. Aircraft behaviour of the stall is gentle, and recovery is quickly accomplished by the following actions:

a. Release back pressure.

b. Simultaneously apply full throttle.

c. Stop yaw: in the event of a wind drop, apply sufficient rudder to prevent further yaw.

d. When wings become unstalled, level them with aileron.

e. Raise nose above level-flight attitude to prevent any further loss of altitude, and initiate a climb.

SPINS

16. Spin characteristics generally follow the normal pattern, and recovery is as follows:

a. Close throttle.

b. Raise flaps.

c. Apply full opposite rudder.

d. Move the control yoke steadily forward until the spin stops.

e. Centralize rudder.

f. Level wings.

g. Ease out of the dive.

CAUTION

The aircraft will recover a two-turn spin in one-half to one turn. Intentional spins are limited to two turns due to increased recovery time resulting from a fully developed spin.

OPERATION OF COCKPIT HEATING AND DEFROSTING SYSTEM

17. For maximum defrost, the cockpit heat/vent controls should be in the following positions to provide maximum removal or prevention of windshield frost or ice accumulation:

a. CABIN HEAT - Out (ON).

b. CABIN AIR - Out (OFF).

c. DEFROST - Out (ON).

d. For maximum cockpit heat, the cockpit heat/vent controls should be selected as follows:

(1) CABIN HEAT - Out (ON).
(2) CABIN AIR - In (ON).
(3) DEFROST - In (off).

Intermediate settings may be selected as required to meet less than extreme flight conditions.

PRE-LANDING CHECK

18. Prior to descent for landing, complete the following checks and actions:

a. Fuel selector - Select fullest tank.

b. FUEL BOOST pump - ON (check pressure rising and stabilized).

c. MIXTURE control - Rich.

d. CARB HEAT control - As required.

e. Brakes - Off; check pressure.

f. Harness - Tight.

NORMAL DESCENT

19. Descent may be achieved using power, or with power off. In any descent, pay careful attention to maintenance of operating temperatures. During long descents, clear the engine approximately every 500 feet. After the turn onto the base leg of the circuit, power may be reduced to approximately 1500 RPM. This power setting and an airspeed of 80 knots IAS will produce a rate of descent of approximately 500 feet per minute (FPM). Initial selection of flaps is made as required, but at an airspeed of 96 knots IAS or below. On final, reduce the airspeed further to 70 knots IAS, and maintain the aircraft on the approach path by the correct use of flap and power. At 70 knots, good control of the aircraft is retained and good visibility is maintained.

NORMAL LANDING

20. The landing characteristics of the aircraft are normal for a single-engined, propeller-driven aircraft equipped with a tricycle landing gear. As the aircraft passes through approximately 10 feet above ground level (AGL), commence a gradual round-out by a gradual increase of back pressure on the control yoke. As the aircraft touches the ground, it will be in a slightly nose-high attitude, so that the main wheels will contact the runway first. As the landing roll progresses, relax back pressure on the control gradually to lower the nose wheel to the runway. Immediately raise flap. Maintain directional control of the aircraft during the landing roll, initially with rudder or brake, or a combination of both. After the nose wheel has contacted the runway, most of the rudder effectiveness will have been lost, and directional control is maintained with nose-wheel steering, or brakes, or a combination of both.

WHEELBARROWING

21. Wheelbarrowing may be described as an attitude or condition that is encountered after initial ground contact during the landing roll-out. In this condition, the main wheels are lightly loaded or clear of the runway. The nose wheel is firmly in contact with the runway, thus causing the nose gear to support a greater than normal percentage of the aircraft weight, while at the same time providing the only means of steering. In a crosswind in this condition, the aircraft tends to pivot rapidly about the nose wheel. Other indications are wheel skipping and/or extreme loss of braking capability.

22. Normally, wheelbarrowing will be encountered in the following circumstances:

a. On landing, when too high a touch-down speed is employed, particularly in full-flap configuration.

b. On take-off or touch-and-go, when full power is applied in full-flap configuration.

23. If forward pressure on the control yoke is applied under either of these conditions, wheelbarrowing will be aggravated.

24. In order to recover from a wheelbarrowing condition, use the following techniques:

a. Raise flap.

b. Simultaneously close throttle.

c. Apply back pressure to the control yoke to bring it aft of the neutral position.

d. Employ nose-wheel steering and braking to regain control of the aircraft, or, if the aircraft is not pivoting and sufficient runway remains, overshoot.

PORPOISING

25. Porpoising can be described as a series of bounces back and forth from the nose wheel to the main wheels. It is usually caused by touching down on the nose wheel first through improper hold-off techniques, or by over-controlling while correcting for a bounce on landing. It can also be caused by an abrupt forward movement of the control yoke at the point of touch-down.

26. In order to recover from a porpoise, use the following techniques:

a. Hold the control yoke in the neutral or just slightly aft-of-neutral position and allow the aircraft to settle back towards the runway and then hold off again.

OR

b. If the porpoise is severe or insufficient runway remains to attempt another landing, apply full power while keeping the control yoke neutral and overshoot.

CAUTION

Do not pump the control yoke during a porpoise; this will aggravate the situation and may result in structural damage to the aircraft.

CROSSWIND HANDLING

27. Crosswind characteristics of the aircraft are normal. Ground handling in a crosswind is achieved in the normal way: positioning the ailerons and stabilator so that the wind will least affect them. It may be necessary to reduce the taxi speed slightly in a crosswind to ensure safe handling. In the air, the aircraft should be crabbed to compensate for drift. During the approach and landing phases of flight, the preferred method of compensating for a crosswind is to keep the into-wind wing down, meanwhile maintaining the aircraft along the desired flight path by a corresponding application of opposite rudder.

MINIMUM-ROLL LANDINGS

28. Because of brake failure, runway length or the condition of the runway surface, it may be necessary to stop in the minimum distance after touch-down. If the approach path is clear of obstacles, a drag approach may be used. If obstacles preclude the use of a drag approach, an elevated approach is required. The aim of both approaches is for the aircraft to touch down at normal touch-down speed, close to the approach end of the runway so that the landing roll is as short as possible. Final approach in both cases is a power-assisted approach of 65 knots, using full flap. Under light wind conditions, it may be necessary to extend the downwind leg to ensure that a power-assisted approach is possible.

29. The basic difference between the two types of approach is the distance of the round-out point from the intended landing spot. In the elevated type, the round-out is at approximately 5 feet AGL, which allows a short float period before touch-down. In the drag type, the round-out is completed at 3 feet AGL, some distance from the spot, and the aircraft is flown in a nose-up attitude with power on until it reaches the landing spot. The round-out spot must be chosen while on downwind, and the distance from the touch-down point depends on the ground features and wind strength. The touch-down is on the main wheels, and the nose wheel is then lowered to the ground. As soon as all three wheels are firmly on the ground, the flaps are raised and brakes applied to bring the aircraft to a stop. A progressive increase in back pressure on the control yoke while braking will keep the aircraft firmly on the ground.

CAUTION

Avoid harsh or excessive use of the brakes to prevent overheating and tire damage.

POST-FLIGHT CHECKS

POST-LANDING CHECK

30. After landing, complete the following:

a. Flaps - Check retracted.

b. CARB HEAT - above -10°C OAT - Cold.

- -10°C OAT - Hot.

c. COWL FLAP - As required.

d. Switches - ON/off (as required).

- Wing STROBE light - Off.

e. Radio/Nav aids - Reset/OFF as required.

f. Cockpit doors - Unlocked.

POWER CHECK

31. Carry out the following checks just before engine shut-down:

a. Parking brake - Set.

b. Area - Clear.

c. Throttle - 2200 RPM.

d. Magnetos - Check drop.

If unserviceable -

Throttle - 2100 RPM.
Mixture - Lean 30 seconds (2080 RPM); then rich.
Throttle - 2200 RPM.
Magnetos - Recheck drop.

(If still unserviceable on shut-down, record aircraft unserviceable on form CF 335.)

e. Throttle - 1000 to 1200 RPM.

f. Radios - Check 121.5 for DAL tone.

SHUT-DOWN CHECK

32. To shut down the engine, proceed as follows:

a. Parking brake - Set.

b. CARB HEAT control - Cold.

c. Throttle and engine RPM - Set for 800 RPM.

d. Magneto/START switch - Check (for dead/live magnetos).

e. MIXTURE control - Idle cut-off.

f. Fuel selector - OFF.

g. When propeller stops -

Magneto/START switch - Off.
Radios/Nav aids - Off.
AVIONIC MASTER - Off.
Lights - Off.
[illegible] DELETED
ROTATING BEACON - Off.

h. COWL FLAP - Closed.

j. ALT - Off.

k. BTY - Off.

m. Control lock - Install.

n. Chocks - In place.

p. Parking brake - Off.

q. Door-securing arm - Set (as required).

AEROBATIC MANOEUVRES

PRE-STALL, SPIN, AEROBATIC (PSSA) CHECK

33. Before performing any of the aerobatic manoeuvres listed in paragraph 34, carry out the following checks and actions:

* A - Altitude - As required by B-OA-100-001/AA-000 (CFP 100).
- Area - Not over built-up or other restricted area.

H - Harness - Tight.
- Helmet - Secure.

* T - Trim - Set for level flight.
- Temperatures and pressures - Check within operating limits.

M - MIXTURE control - Rich.
- CARB HEAT control - Check for carburettor ice and set cold.

* F - Fuel selector - Set to fullest tank; check pressure.
- Flaps - Retracted.
- COWL FLAP - Set as required.

S - Switches -

Magneto/START - BOTH.
BTY - ON.
ALT - ON.

C - Cockpit doors - Secure.

* L - Loose articles - Secured.
- Look-out - Clearing turns.

APPROVED AEROBATICS

34. The aircraft is approved for the following aerobatic manoeuvres:

a. Stall.

b. Spin.

c. Chandelle.

d. Lazy Eight.

e. Stall turn.

f. Loop.

g. Roll.

h. Manoeuvres involving combinations of the above.

*Mini PSSA CHECK ITEMS - After an initial PSSA CHECK, a 'mini' check only is required for subsequent manoeuvres.

OPERATION OF ENGINE CONTROLS

MIXTURE CONTROL-LEANING

35. The mixture control, in addition to incorporating an idle cut-off when fully closed, can be used to manually lean the fuel-air mixture. The mixture control must be maintained in 'full rich' position for all operations where more than 75% power is being used, except when rough running or loss of power occurs under the following circumstances.

a. During take-off from high-elevation airfields.

b. During climb at higher altitudes (normally above 5000 feet ASL).

NOTE - During extended engine operation below 75% power, rough running will usually develop. Leaning will correct this condition.

36. Leaning to prevent rough running is achieved by adjusting the mixture, but only enough to obtain smooth engine operation.

37. Leaning for economy cruise at 75% power or below is accomplished by slowly moving the mixture control toward the lean position. It will be noted that as the control is gradually moved, the engine will start to pick up RPM. An increase in RPM will be more noticeable above 5000 feet, because of the excessively rich mixture. Continue to lean out the mixture until the engine begins to run rough. At this point, the engine will have reached and passed through maximum RPM. Enrich the mixture by moving the mixture control forward just enough to smooth out the engine. At this point, the engine is operating at approximately 3% below the maximum RPM.

38. If it is desired to operate at a different power setting, a different altitude, or if carburettor heat is used, enrich the mixture and repeat the leaning procedure as described above.

CARBURETTOR HEAT CONTROL

39. Carburettor icing occurs when moisture, contained in ambient air condenses and freezes, generally in the area of the throttle valve. The moisture will condense when the temperature drop in the carburettor lowers the air temperature below its dew-point temperature. Carburettor icing can occur over a wide range of ambient temperatures. To assist the pilot in recognizing the conditions conducive to carburettor icing, the Musketeer is fitted with a carburettor air temperature gauge. This CARB TEMP gauge has a yellow cautionary range extending from -15° to +5°C. When the carburettor air temperature is below -15°C, icing is unlikely, since moisture will condense as ice crystals. When the carburettor air temperature is above +15°C, the moisture that condenses will not freeze. Carburettor icing will normally occur when the carburettor air temperature is between -15°C and +5°C. The conditions most conducive to carburettor icing are high ambient relative humidity, and low or idle engine power setting. Icing is least likely to be encountered at full throttle settings, or when the ambient temperature is below approximately -12°C.

40. Operate the CARB HEAT control as follows:

a. On the ground, above -10°C OAT, limit the use of carburettor heat to the operation of the control in order to check the correct functioning and to check for icing during run-up. At or below -10°C OAT, the CARB HEAT control is in the 'hot' position for take-off until full power is set.

b. Take-off shall be performed with the CARB HEAT control in the 'cold' position.

c. During level-flight cruise and aerobatic manoeuvres, the CARB HEAT control is left in the 'cold' position, unless carburettor icing is experienced or suspected. If this occurs, carry out a carburettor-ice check, as follows:

(1) Check airspeed and RPM.

(2) CARB HEAT 'hot' for 20 to 30 seconds.

(3) Check airspeed is the same as in (1).

(4) CARB HEAT 'cold'.

(5) Recheck RPM - if it is higher than in (1), then carburettor icing has been encountered.

d. If carburettor icing is verified, leave the icing area (if applicable, discontinue the flight). After carburettor icing has been removed by the carburettor-ice-check procedures, adjust the CARB HEAT control so that the carburettor air temperature is 5 to 10 degrees above the cautionary range of the CARB TEMP gauge.

e. If the ambient temperature is below +7°C, routinely apply full carburettor heat by pulling the CARB HEAT control 'on' in the following situations:

(1) One minute prior to low- or idle-power descents.

(2) During FMS check of a PFL.

(3) On the downwind leg of a circuit.

(4) During last clearing turn when performing stalls and spins.

f. Leave the CARB HEAT 'on' during the descent or approach. Push the control to 'cold' after applying power for level-off or overshoot.

g. Apply carburettor heat any time carburettor icing is suspected. Be particularly cautious of carburettor icing under high humidity conditions during flights at low altitude. During cruise, take note of the carburettor air temperature reading and periodically conduct carburettor-ice checks if the reading is in the cautionary range. Avoid consistently high carburettor air temperatures which result in loss of power and/or variations in the fuel-air mixture.

NOTE - Carburettor heat may cause excessive richness and rough running of the engine. If rough running occurs, lean the mixture until the engine runs smoothly.

FUEL BOOST PUMPS

41. The fuel boost pump is used for all conditions of flight. Use the No. 2 pump as a back-up in the event of a No. 1 pump failure. If the engine driven pump fails, the aircraft engine will operate on fuel-boost-pump pressure alone.

COLD-WEATHER OPERATIONS

MODIFICATIONS

42. At ambient temperatures below -4°C (approximately), engine hesitation becomes apparent during throttle advances from a low power setting. At these temperatures, difficulty is encountered in maintaining the oil temperature in the 'normal' operating range. Throttle response is inadequate when the oil temperature is in the 'caution' range, because the output pressure of the engine-driven fuel pump decreases as the ambient temperature decreases.

NOTE - Low fuel pressure has been observed with the ambient temperatures as high as -7°C.

43. To help minimize these problems, a number of modifications have been installed in the aircraft:

a. A winter cowl flap is located in the air exit of the engine compartment on the bottom of the forward fuselage. It is used to control the flow of cold air through the engine compartment. The cowl flap is operated by a control on the left sub-panel.

b. A red blanking plate is also installed for winter operation. It cuts off airflow through the oil cooler. The plate helps to maintain the oil temperature in the normal operating range; however, caution is required during low or idle power manoeuvres to ensure that the oil temperature does not decrease below the normal operating range.

c. A baffle plate is installed over the carburettor-air intake on the nose of the aircraft. This plate reduces the ram effect of cold air entering the carburettor and thereby helps to reduce the severity of engine hesitation during throttle advances.

d. A second boost pump has been installed in order to provide the reliability of dual fuel pumps, regardless of outside air temperatures.

OPERATING DATA

44. The cold-weather procedures described here are a supplement to normal operating procedures. All engine limitations and flight restrictions contained in Part 4 are applicable for cold-weather operation.

BEFORE ENTERING COCKPIT

45. Check the entire aircraft for freedom from frost, snow, and ice. Loss of lift and stalls, which could be disastrous, particularly during take-off, may result if the aircraft is not adequately cleaned. Brush off all light snow or frost. Do not chip or scrape ice, because damage to the aircraft skin may result; apply de-icing fluid to remove ice.

46. Check the engine cowl flap.

ENGINE START

47. Ensure COWL FLAP is open for engine start.

48. Although Musketeer aircraft are normally hangared between flights when the ambient temperature is low, occasions may arise when the aircraft will have to be started after cold soaking. Under these circumstances, up to 10 priming strokes may be required, depending on the OAT and the indicated oil temperature. If the engine is still warm from a previous flight, one to three shots of prime is generally sufficient.

49. Warm up the engine in the 1000 to 1200 RPM range. If the aircraft has been cold soaking or the ambient temperature is very cold, close the engine COWL FLAP to reduce the engine warm-up time. At -10°C OAT or below, CARB HEAT is selected 'hot' to promote proper fuel volitization and prevent fouling of spark plugs.

NOTE - Air entering the carburettor with CARB HEAT selected 'hot' is not filtered. In dusty conditions, regardless of OAT, CARB HEAT should be selected 'cold' while the aircraft is on the ground to prevent dust and foreign matter from entering the engine.

GROUND CHECKS

50. The windshield defrost system has limited capability at very low temperatures - pull it ON as soon as possible after starting; select the CABIN AIR control OFF to increase the windshield defrosting airflow.

51. Check the COWL FLAP control for smooth operation.

52. Make normal carburettor heat checks on the ground to ensure it is functioning properly.

ENGINE RUN-UP

53. Prior to engine run-up, ensure the following:

a. Engine oil temperature is off the peg.

b. Aircraft is not parked on packed snow or ice.

c. CARB HEAT is in the 'hot' position if OAT is -10°C or below.

54. Low ambient temperatures do not affect the magneto drop. Normal limits apply.

PRE-TAKE-OFF CHECK

55. For take-off, ensure the following:

a. COWL FLAP is adjusted as required.

b. CARB HEAT control is in the 'cold' position when OAT is above -10°C.

OR

c. CARB HEAT control is in the 'hot' position when the OAT is -10°C or below, to prevent engine hesitation during take-off.

56. At low ambient temperatures, the engine oil temperature may not have increased to the minimum of normal operating range by the time the run-up check has been completed. Take-off is permitted when oil temperatures off the peg but below the normal operating range.

TAKE-OFF

57. Apply throttle smoothly. If the CARB HEAT control is in the 'hot' position, smoothly select 'cold' when full-throttle movement and RPM is attained.

NORMAL CLIMB

58. Check the cylinder-head temperature and oil temperature during the climb and adjust the COWL FLAP if required. A CHT of approximately 200°C will provide a satisfactory rate of increase of oil temperatures. The oil temperatures should increase to the normal operating range within 5 minutes after take-off.

LEVEL-FLIGHT CRUISE

59. For maximum engine life, the engine manufacturer recommends that the cylinder-head temperature be maintained as follows:

a. Below 224°C during high-performance cruise.

b. Below 205°C during economy cruise (see para 37). Flight tests have indicated that maintaining the CHT above (approximately) 175°C is sufficient to ensure that the oil temperature remains within the normal operating range, even when the OAT is low. Therefore, during level-flight cruise, adjust the COWL FLAP as required to maintain the CHT in the range of 175° to 224°C.

DESCENT

60. Apply full carburettor heat approximately 1 minute prior to anticipated low-power descents. Pull the COWL FLAP closed to minimize engine heat loss. After applying power for level-off, remove CARB HEAT and adjust the COWL FLAP as required.

APPROACH AND LANDING

61. During an approach and landing, apply full carburettor heat on the downwind leg of the circuit and maintain ON until landing. In the event of an overshoot or touch-and-go landing, apply full power and then remove carburettor heat.

GLIDE AND PFL
(OAT Below 7°C)

62. Before commencing idle power manoeuvres such as glides and practice landings, ensure that the engine oil temperature is within the normal operating range. Apply full carburettor heat approximately 1 minute before commencing a low power descent and during the FMS check of a PFL. Close the COWL FLAP to minimize engine heat loss. Closely monitor the engine oil temperature, and if it drops to the cautionary range, discontinue the exercise. Clear the engine every 500 feet by advancing the throttle smoothly to full power for 1 to 2 seconds. After applying power for the level-off, remove CARB HEAT and adjust the COWL FLAP as required.

POST-FLIGHT CHECKS

63. Prior to shut-down, conduct the post-flight check and power check at OAT of -10°C or below. Ensure that the CARB HEAT control is in the 'hot' position during the post-landing check. Ensure that the aircraft is not parked on snow or ice, and that the engine cowl flap is in the full open position.

COLD-WEATHER OPERATION OF ENGINE CONTROLS

THROTTLE HANDLING

64. During cold-weather operation, throttle handling can be critical since rapid throttle advances from idle power settings can result in excessive engine hesitation. Cold weather tests have shown that the extent of hesitation encountered depends on both engine oil temperature and rate of throttle advance. Throttle response is unsatisfactory if the entire oil temperature is below the 'normal' operating range.

CAUTION

Rapid throttle advances from idle power settings can cause the engine to run down and stop. If the engine fails to accelerate on throttle advancement, return the throttle slowly (3 to 4 seconds). The optimum throttle-handling technique is to advance the throttle slightly (approximately I inch), wait for the engine to accelerate, and then advance the throttle smoothly.

MIXTURE CONTROL

65. Low ambient temperatures do not affect the operating procedures for the engine mixture control. In general, piston engines run leaner in cold weather than in warm weather, and therefore, slightly less leaning is required at low ambient temperatures than at high temperatures.

CARBURETTOR HEAT

66. When full carburettor heat is applied at a very low temperature (below -26°C approximately), the carburettor-air temperature may increase to the caution range. In this case there is no danger of carburettor icing since the carburettor-air temperature is significantly higher than the OAT.

67. The application of full CARB HEAT prior to PFLs and other low-power manoeuvres helps to minimize the oil temperature drop, and, therefore, helps to reduce engine hesitation.

NOTE - The rapid selection of CARB HEAT - 'hot' can result in momentary engine hesitation due to the induced change in the air/fuel mixture. Application of CARB HEAT should be smooth to ensure normal engine operation.

COWL FLAPS

68. Adjust the COWL FLAP to maintain the CHT in the normal operating range.

PART 3

EMERGENCY OPERATING PROCEDURES

SECTION I

NON-CRITICAL EMERGENCIES

EMERGENCIES IN THIS SECTION ARE CONSIDERED TO BE OF A NON-CRITICAL NATURE. SUFFICIENT TIME IS AVAILABLE TO CONSULT THE CHECK LIST FOR REMEDIAL ACTION.

ELECTRICAL FAILURE

1. In the event of electrical failure, check the following:

a. ALT switch - OFF.

b. BTY switch - ON.

c. AVIONIC MASTER - Off.

d. Radios - Off.

e. Electrical services - OFF.

f. ALT circuit breaker - Pull and reset.

g. ALT FIELD circuit breaker - Pull and reset.

h. ALT switch - ON.

j. Ammeter - Check for positive reading.

k. If the alternator is not operating, leave off non-essential electrical equipment to conserve the battery.

m. AVIONIC MASTER - ON.

n. Radios - ON.

p. Electrical services - ON.

q. Land as soon as practicable.

LANDING WITH FLAT TIRE

2. In the event that it is known a tire has gone flat, certain precautions may be taken to minimize the resultant handling difficulties which may be expected during the landing. Regardless of the location of the flat tire, make a normal approach, with full flap. If the flat tire is on one of the main wheels, select the touch-down point on the side of the runway corresponding to the good main wheel. This allows extra room for manoeuvring as a result of the extra drag which can be expected when the flat tire contacts the runway. During the landing roll, hold the main wheel with the flat tire off the runway as long as possible by the use of aileron. When the flat tire contacts the runway, maintain directional control in the normal manner with nose-wheel steering, or brake, or a combination of both. Avoid use of brakes on the main wheel with the flat tire: this will only increase the drag on that wheel and the tendency for the aircraft to swerve.

LOW OIL PRESSURE

3. In the event of low oil-pressure readings on the combined oil pressure/temperature gauge, carry out the following actions:

a. Reduce power as much as possible.

b. Land as soon as practicable.

DOOR OPENING IN FLIGHT

4. In the event of door opening during flight, proceed as follows:

a. If only top or bottom of the door is open, return to base and land.

b. If the door is in the trail position, reduce airspeed to 80 knots IAS and attempt to close the door. If unable to close the door, land, increasing approach speed by 5 to 10 knots. The door may be readily closed when the aircraft is stopped on the ground.

DISTRESS PROCEDURE

5. Lost - Proceed as follows:

   a. Gain altitude, but remain clear of cloud.

   b. Reduce airspeed to 80 knots IAS.

   c. Call tower: "I AM LOST. REQUEST VHF HOMING".

   d. If unable to contact tower, change to 121.5 MHz and make general distress broadcast, giving aircraft identification, base, altitude, and heading.

   e. Set transponder to 7700.

6. Emergency - Proceed as follows:

   a. Transmit PAN or MAYDAY, giving aircraft number on the frequency with which contact with tower facility is being maintained.

   b. If unable to contact tower facility on the preset frequency, re-attempt on emergency frequency - 121.5 MHz.

   c. Give position and as many details as time permits.

   d. If required to force land: DAL transmit - ON; Transponder - Set 7700.

STARTER ENGAGED WARNING LIGHT

7. The STARTER ENGAGED warning light illuminates whenever the starter is engaged. If this light remains illuminated after magneto/START switch is released from the START position, the starter relay is still energized; consequently, electrical power is still being supplied to the starter, and it remains engaged.

CAUTION

Continuing to supply power to the starter will eventually result in the complete loss of electrical system power, substantial starter damage, and possible damage to other electrical system components.

8. If light remains illuminated on the ground:

   a. BTY switch and ALT switch - OFF.

   b. Do NOT take off.

9. If light illuminates in flight or after air start:

   a. BTY switch and ALT switch - OFF.

   b. Land as soon as practical.

10. If light fails to illuminate during start:

   a. Ensure that the ammeter indication is less than 25% of full charge at 1000 to 1200 RPM within two minutes with no additional electrical equipment on.

   b. If not, turn off the BTY switch and ALT switch and do not take off.

SECTION 2

CRITICAL EMERGENCIES

EMERGENCIES IN THIS SECTION ARE CONSIDERED TO BE OF A CRITICAL NATURE. THESE PROCEDURES SHOULD BE PERFORMED IMMEDIATELY AND INSTINCTIVELY, WITHOUT REFERENCE TO WRITTEN CHECK LISTS, AND SHOULD BE COMMITTED TO MEMORY.

ACTION IN THE EVENT OF FIRE

FIRE ON THE GROUND

1. The Musketeer aircraft is not equipped with a fire-extinguishing system. The hand-operated fire extinguisher, located in front of the rear seats (see Figure 1-7), is of limited capability and is to be used primarily against small fires which could occur in the cockpit area. Should an engine fire occur on the ground, the following procedures shall apply:

a. Do not attempt to deal with the fire by either trying to fight it or by opening the throttle until the propeller has stopped. At the first signs of a fire, proceed as follows:

(1) Throttle - Close.

(2) MIXTURE control - Idle cut-off.

(3) Fuel selector - OFF.

(4) Magneto/START switch - OFF.

(5) BTY switch - Off.

(6) Abandon aircraft - Line crew and/or fire fighters shall deal with the fire.

b. Do not attempt to restart the engine until the cause of the fire has been ascertained and the fault rectified.

FIRE IN THE AIR

2. Side-slip the aircraft, if necessary, so that flames and/or fumes are not directed toward and into the cockpit. Simultaneously, proceed as follows:

a. Throttle - Close.

b. MIXTURE control - Idle cut-off.

c. Fuel selector - OFF.

d. DEFROST control - Closed (push).

e. CABIN AIR control - Closed (pull).

f. FUEL BOOST pump - Off.

g. ALT switch - Off.

h. Magneto/START switch - OFF.

j. Ventilation (as required):
- Nozzle vents - Open.
- Storm vent (left door) - Open.
- Right door - Open to trail position as required.

k. Transmit MAYDAY and intentions.

m. DAL - TX ON.

n. BTY switch - Off.

p. Brakes - Off.

q. Harness - Tight.

r. Carry out a forced landing.

s. Abandon aircraft after landing.

COCKPIT FIRE

3. In the event of a cockpit fire, proceed as follows:

a. Fight fire - Use hand fire extinguisher as required.

b. Ventilate:
- Nozzle vents - Open.
- Storm vent (left door) - Open.
- Right door - Trail (as required).

NOTE - The bromo trifluoromethane in the hand-operated fire extinguisher is non-toxic, but mildly noxious; therefore, cockpit ventilation may be required after use.

c. Land as soon as practicable.

ELECTRICAL FIRE

4. In the event of an electrical fire in the aircraft, signified by the acrid smell of burnt insulation (smoke may not necessarily accompany such a fire), complete the following actions:

a. BTY switch - Off.

b. ALT switch - Off.

c. AVIONIC MASTER - OFF.

d. All radios and electrical equipment - Off.

e. DEFROST - Close (push).

f. CABIN AIR - Close (pull).

g. Fight fire - Use hand fire extinguisher as required.

h. Ventilate:
- Nozzle vents - Open.
- Storm vent - Open.
- Right door - Trail as required.

j. BTY switch - ON; check for recurring symptoms of malfunction.

k. ALT switch - ON and check.

m. AVIONIC MASTER - ON.

n. Necessary electrical services - Individually ON; faulty system OFF, and circuit breaker pulled.

p. Land as soon as practicable.

ENGINE FAILURE

ENGINE FAILURE DURING TAKE-OFF ROLL

5. When engine failure occurs during take-off roll, proceed as follows:

a. Throttle - Close.

b. Maintain directional control using nose-wheel steering, or brakes, or a combination of both.

c. Stop aircraft in shortest safe distance.

ENGINE FAILURE AIRBORNE

6. When engine fails after becoming airborne, proceed as follows:

a. Throttle - Close.

b. Glide at 75 knots IAS.

c. Select a forced-landing area and head for it.

d. If time permits, carry out a FMS check:

F - FUEL
- FUEL BOOST - On (Check Pressure).

If no pressure:
- Fuel selector - Change tanks.
- Pressure and contents - Check.

M - MIXTURE control - Rich.
- CARB HEAT control - Hot.

S - SWITCHES
- Magneto/START - BOTH.

NOTE - If the propeller has stopped, the Magneto/START switch is to be selected to the START position.

e. If the engine fails to start, carry out a forced landing.

f. MAYDAY and Intentions - Transmit (time permitting).

g. DAL - TX ON.

h. Recheck forced-landing area.

j. Carry out shut-down check:

F - FUEL
- Fuel Selector - OFF.

M - MIXTURE control - ICO.

S - SWITCHES
- FUEL BOOST - Off.
- ALT switch - Off.
- BTY switch - Off.
- Magneto/START switch - Off.

k. Brakes - Off.

m. Harness - Tight.

n. Carry out landing.

7. The loss of one magneto may cause engine rough running and/or partial power failure. If this situation is encountered and it cannot be rectified by an FMS check (also check primer) and a LANDING ON AN UNPREPARED SURFACE IS INEVITABLE, a magneto check may be required to isolate the faulty magneto. The throttle must be at idle prior to the check. If the engine runs smoothly on one magneto, advance the throttle as long as smooth operation continues. If neither position improves the situation, reselect BOTH and open the throttle to regain whatever power is available. The magneto check should be a 'last resort only' procedure.

8. The full forced-landing pattern is a 360-degree, 75-knot IAS gliding turn flown in relation to ground reference points picked during the pattern. At 75 knots IAS, the rate of descent is 870 FPM, the glide ratio is 9:1, and the distance is 1.5 nautical miles covered for every 1000-foot loss of altitude. During the gliding turn, altitude loss varies with airspeed and bank. At 20 degrees bank the minimum loss occurs using 75 knots IAS and is 1350 feet in a 360-degree pattern.

9. There are three ground reference points chosen during a complete pattern; high key, low key, and final key. High key is 1500 feet above ground, directly over the touch-down point, heading in the direction of landing. Low key is 900 feet above ground halfway around the circle, opposite the touch-down point, heading downwind. Final key is 500 feet above ground, halfway between low key and the touch-down point on the circumference of the circular pattern.

10. From high key, the position of low key is determined by looking down the lowered wing at the commencement of the turn while using 20 degrees of bank. Under no-wind conditions, 20 degrees of bank should suffice to bring the aircraft onto final in position to land within the first third of the field. Usually, there will be a wind, and the rate of turn must be adjusted to allow for drift by varying the amount of bank to increase or decrease the rate of turn. At 75 knots IAS, the maximum bank that will provide a 7.5-knot safety margin over the stall is 30 degrees. When more than 30 degrees of bank is required, the airspeed must be increased and, consequently, altitude loss will increase.

CAUTION

The stall-warning horn does not function with the BTY switch off.

11. Flaps may be used at any position in the pattern to help maintain the desired rate of descent; however, full flaps should not be used until it is positive that the desired point of landing is assured. The desired point of landing should normally be within the first third of the field. When landing on a runway, the amount of flap used at touch-down should be the same as for a normal safe landing. When landing in an unprepared field, full flap should be selected prior to touch-down so that the touch-down speed is reduced. Final approach is flown at 70 knots IAS. Windshear and drift can be critical during the forced-landing pattern; therefore, when crosswind conditions exist, the turn from high to low key should be into the wind. This will ensure that drift will be toward the field during the final half of the pattern.

12. If engine failure occurs below the high-key altitude of 1500 feet AGL, a field should be chosen which will permit reaching a low- or final-key position at the recommended altitudes.

13. If an aircraft arrives at high key above 2900 feet AGL, a 360-degree gliding turn is carried out prior to execution of the pattern. If the aircraft arrives at high key above 1500 feet AGL, but with insufficient altitude for an orbit, then the excess altitude is lost after high key by gliding upwind for one-half of the excess altitude. The remaining excess altitude is lost flying downwind toward the low-key position. From low key on, the pattern is flown in the normal manner.

14. In the event of a partial power loss, carry out the normal Total Power Failure Checks in an attempt to determine the cause. If the condition cannot be rectified, the decision to carry out a forced landing or attempt to return to base will be dictated by the circumstances.

PRACTICE FORCED LANDING

15. In order to practise forced landing procedures, the Musketeer is configured with engine at flight-idle and 25 degrees of flap selected. In this configuration, gliding performance is 4 per cent better than with the engine off.

PART 4

OPERATING DATA

INTRODUCTION

1. This part contains the engine and airframe operating limitations and the performance data required for pre-flight planning.

ENGINE LIMITATIONS

MAXIMUM ALLOWABLE RPM

2. The maximum allowable engine speed is 2700 RPM. There is no time limit on operation up to 2700 RPM. All speeds in excess of 2700 RPM are classed as overspeeds and must be reported in the Aircraft Maintenance Record Set.

MIXTURE CONTROL

3. The mixture is to be fully rich for take-off, climb, and all power settings above 75% power.

NOTE - During take-off from high-elevation airports, or during climb at higher altitudes, roughness or reduction of power may occur at fully rich mixture. In such a case the mixture may be adjusted, but only enough to obtain smooth engine operation. Monitor cylinder-head temperature closely.

INSTRUMENT MARKINGS

4. Engine operation limits and instrument range markings are given in Figure 4-2.

FLIGHT RESTRICTIONS

WEIGHT AND BALANCE LIMITATIONS

5. Maximum gross take-off or landing weights and centre-of-gravity (CG) limits for both Normal and Aerobatic categories are given in Figure 4-1. In addition to the weight limitations given, the following restrictions apply:

a. Baggage compartment maximum load not to exceed 270 pounds.

b. The rear seats and baggage compartment must be kept empty for operation within the Aerobatic category.

PROHIBITED MANOEUVRES

6. All aerobatic manoeuvres are prohibited when the aircraft is being operated in the Normal category: that is, all manoeuvres involving attitudes of greater than 30 degrees of pitch and 60 degrees of bank.

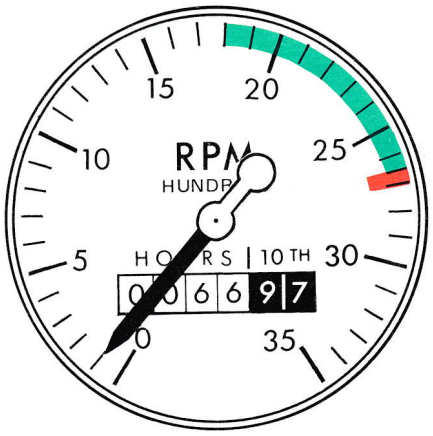
7. When the aircraft is operated in the Aerobatic category, the following manoeuvres are prohibited:

a. Inverted flying or any manoeuvre involving intended negative acceleration.

NOTE - Fuel and oil systems are not designed to operate under negative-G conditions. Sustained negative G will result in first fuel, then oil starvation.

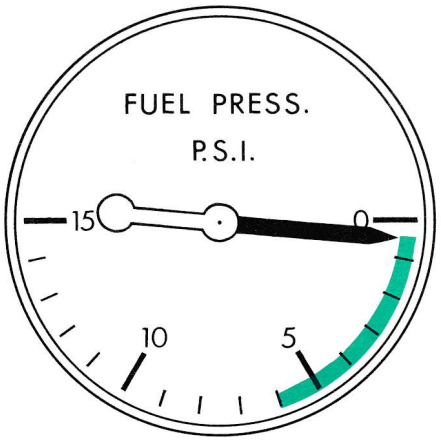
CATEGORY	MAXIMUM GROSS WEIGHT	CG LIMITS (inches aft of reference datum)	
		Forward Limit	Aft Limit
Normal	2450 lb	At 2450 lb 114.5"	118.3"
		At 2100 lb 109.9"	118.3"
		1800 lb or less 107.8"	118.3"
Aerobatic	2250 lb	At 2150 lb 111.4"	114.0"
		At 2100 lb 109.0"	114.0"
		1800 lb or less 107.8"	114.0"

Figure 4-1 Gross Weight and CG Limits



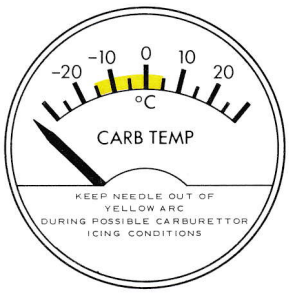
TACHOMETER

1800 – 2700 RPM	NORMAL OPERATION
2700 RPM	MAXIMUM ALLOWABLE



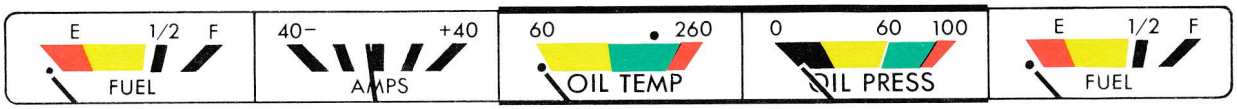
FUEL PRESSURE GAUGE

0.5 – 6.0 PSI	OPERATING RANGE



CARBURETTOR TEMPERATURE GAUGE

- 15°C – + 5°C	CRITICAL ICING RANGE



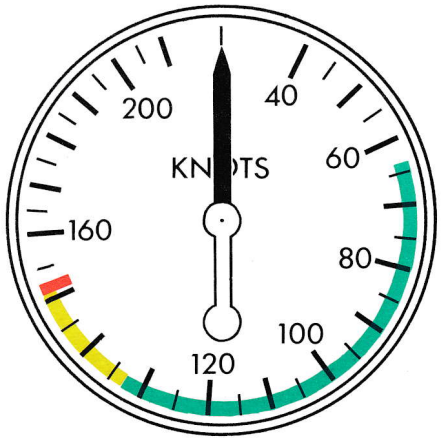
OIL TEMPERATURE GAUGE

60 – 120°F	CAUTION
120 – 245°F	NORMAL
245°F	MAXIMUM

OIL PRESSURE GAUGE

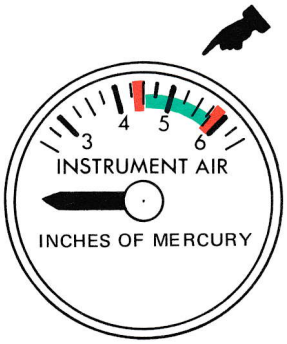
25 PSI	MINIMUM AT IDLE
25 – 60 PSI	CAUTIONARY RANGE
60 – 90 PSI	NORMAL CRUISE
100 PSI	MAXIMUM

Figure 4-2 (Sheet 1 of 2) Instrument Range Markings



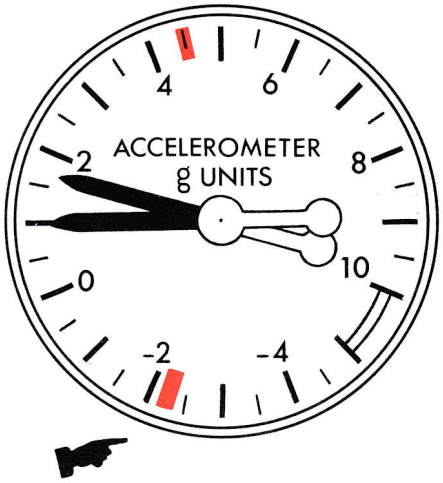
AIRSPEED INDICATOR

	152 Knots	MAXIMUM ALLOWABLE (Glide or Dive – Smooth Air)
	136 Knots	MAXIMUM CRUISE
63 –	133 Knots	NORMAL



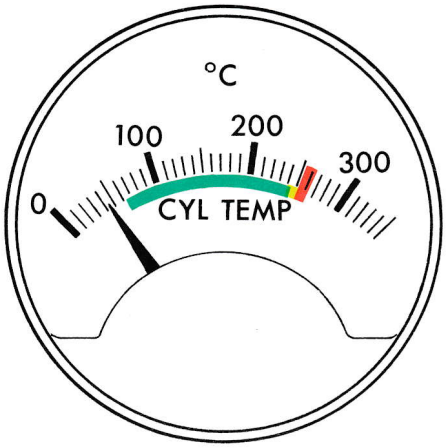
INSTRUMENT AIR SUCTION GAUGE

	4.3" Hg	MINIMUM
4.3 –	5.9" Hg	NORMAL
	5.9" Hg	MAXIMUM



ACCELEROMETER

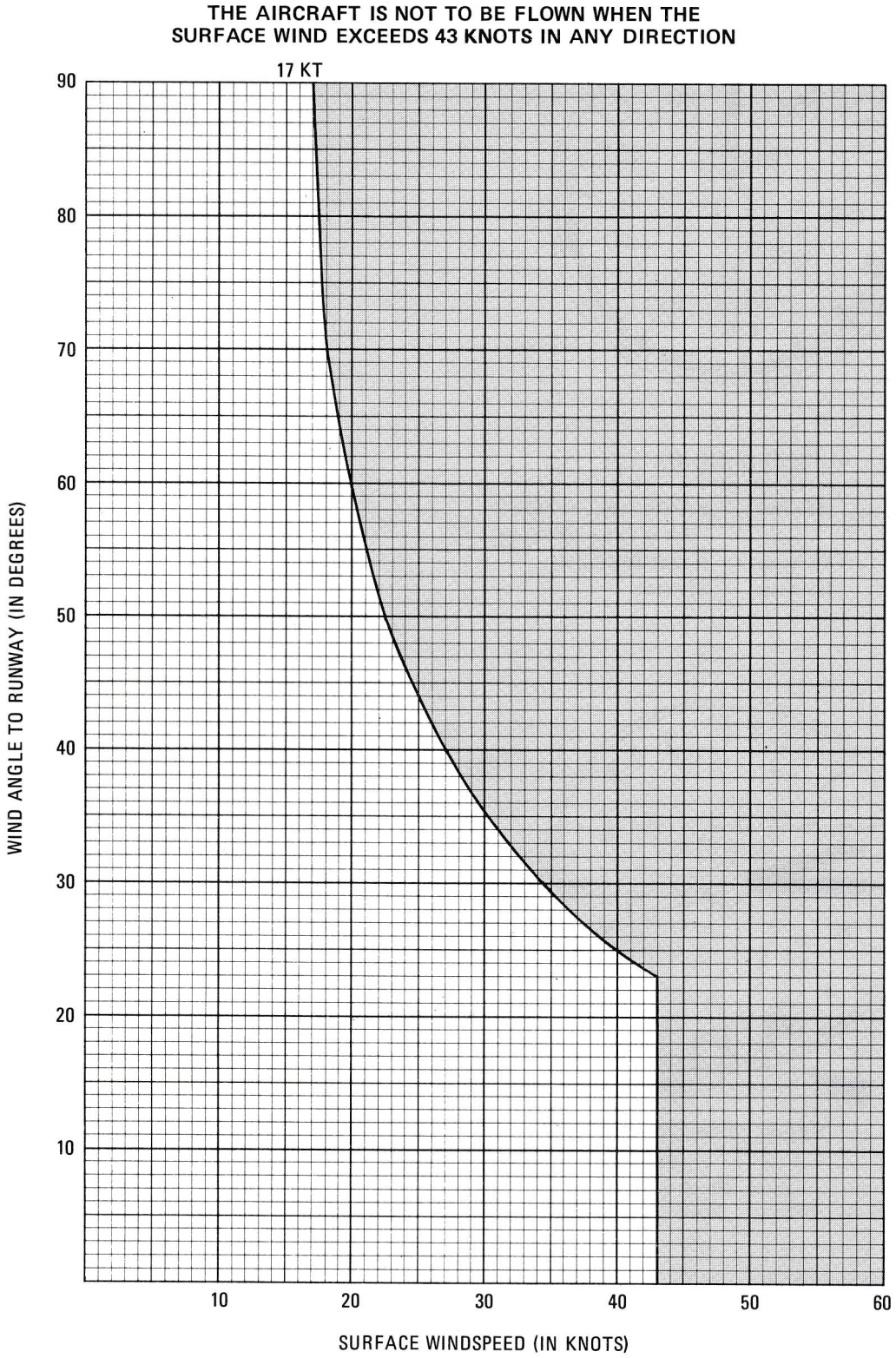
	Normal Category	Aerobatic Category	Flaps Down	
	-1.9 G	-2.25 G	0 G	MAXIMUM NEGATIVE
	3.8 G	4.5 G	1.9 G	MAXIMUM POSITIVE



CYLINDER-HEAD TEMPERATURE

0 –	65°C	CAUTION
65 –	245°C	NORMAL
245 –	260°C	CAUTIONARY
	260°C	MAXIMUM

Figure 4-2 (Sheet 2 of 2) Instrument Range Markings



NOTE — This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-3 Crosswind Component Chart

b. Sprial dives of more than two turns.

NOTE - The foregoing prohibited manoeuvres are in addition to the manoeuvres prohibited according to B-OA-100-001/AA-000, Canadian Forces Flying Orders (CFP 100).

CROSSWIND LIMITATIONS

8. Crosswind limitations are given in Figure 4-3, Crosswind Component Chart.

AIRSPEED LIMITATIONS

9. The airspeed limitations for various conditions of flight are given in Figure 4-4.

CONDITION	SPEED (Knots IAS)
Flap Lowering	96
Manoeuvring (Normal Category)	118
Turbulent-Air Penetration	118
Cruising (Level or Climbing)	136
Maximum Speed (Glide or Dive)	152

Figure 4-4 Airspeed Limitations

RECOMMENDED AIRSPEEDS

10. The airspeeds recommended for various conditions of flight are given in Figure 4-5.

STALLING SPEEDS

11. The stalling speeds for various configurations are given in Figure 4-6. All speeds are given for All-Up Weight (AUW) of 2450 pounds.

CONDITION	SPEED (Knots IAS)	
	2000 lb or less	2450 lb
Take-Off		
- Normal	60	70
- Minimum Roll or Soft Field (15° flap)	45-50	50-55
- Obstacle (15° flap)	50-55	55-60
Approach		
- Normal (35° flap)	65	70
- Obstacle or Minimum Roll (35° flap)	60	65
- Flapless	70	75
Climb		
- Normal	90	
- Obstacle	65	
Glide	75	
Aerobatics		
- Barrel Roll	120	
- Clover Leaf	130	
- Cuban Eight	130	
- Lazy Eight	Cruising Speed	
- Roll	120	
- Looping Manoeuvres	130	
- Roll-Off-The-Top	130	

Figure 4-5 Recommended Airspeeds

ANGLE OF BANK			
LEVEL	30^0	45^0	60^0
FLAPS-UP			
63 kts	67 kts	74 kts	88 kts
FLAPS – DOWN (35^0)			
51 kts	55 kts	61 kts	72 kts

Figure 4-6 Power-Off Stall Speeds

TAKE-OFF DISTANCES – HARD SURFACE

ASSOCIATED CONDITIONS:

POWER	FULL THROTTLE
MIXTURE	RICH
FLAPS	UP
RUNWAY	LEVEL, DRY, HARD SURFACE
WEIGHT	2450 LB

TAKE-OFF SPEEDS:

LIFT OFF	70 KT

WIND COMPONENT DOWN RUNWAY KNOTS	SEA LEVEL				2000 FT				4000 FT				6000 FT				8000 FT			
	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET
0	23	-5	917	1592	16	-9	1046	1805	9	-13	1195	2051	2	-17	1368	2334	-6	-21	1569	2662
	41	5	1020	1767	34	1	1165	2007	27	-3	1333	2284	20	-7	1528	2604	13	-11	1756	2975
	59	15	1130	1955	52	11	1293	2224	45	7	1481	2535	38	3	1701	2894	31	-1	1957	3311
	77	25	1248	2155	70	21	1429	2455	63	17	1640	2802	56	13	1856	3204	49	9	2173	3671
	95	35	1373	2369	88	31	1575	2701	81	27	1809	3087	74	23	2083	3535	67	19	2404	4055
15	23	-5	728	1454	16	-9	836	1653	9	-13	961	1883	2	-17	1108	2149	-6	-21	1279	2456
	41	5	813	1618	34	1	935	1842	27	-3	1077	2102	20	-7	1243	2402	13	-11	1438	2750
	59	15	904	1793	52	11	1042	2045	45	7	1202	2336	38	3	1389	2674	31	-1	1609	3067
	77	25	1003	1980	70	21	1156	2261	63	17	1336	2587	56	13	1546	2965	49	9	1793	3406
	95	35	1107	2180	88	31	1279	2492	81	27	1479	2855	74	23	1714	3277	67	19	1990	3768
30	23	-5	559	1337	16	-9	647	1523	9	-13	751	1739	2	-17	873	1988	-6	-21	1017	2278
	41	5	628	1490	34	1	728	1700	27	-3	847	1944	20	-7	985	2227	13	-11	1149	2555
	59	15	702	1654	52	11	816	1890	45	7	949	2164	38	3	1107	2483	31	-1	1292	2854
	77	25	782	1829	70	21	910	2094	63	17	1060	2401	56	13	1237	2758	49	9	1446	3174
	95	35	868	2017	88	31	1011	2311	81	27	1180	2653	74	23	1378	3052	67	19	1613	3518

NOTE – This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-7 Normal Take-Off Distances

MINIMUM-ROLL TAKE-OFF DISTANCES (FEET)

BASED ON A GROSS WEIGHT OF 2450 LB

MODEL: SUNDOWNER C23 — HARD DRY RUNWAY

ENGINE: 0-360-A4K — 15° FLAP

WIND COMPONENT DOWN RUNWAY KNOTS	SEA LEVEL			2000 FEET			4000 FEET			6000 FEET			8000 FEET		
	OAT °C	GROUND ROLL	CLEAR 50 FEET	OAT °C	GROUND ROLL	CLEAR 50 FEET	OAT °C	GROUND ROLL	CLEAR 50 FEET	OAT °C	GROUND ROLL	CLEAR 50 FEET	OAT °C	GROUND ROLL	CLEAR 50 FEET
0	- 5	771	1123	- 9	879	1275	-13	1005	1451	-17	1150	1654	-21	1319	1889
	5	858	1247	1	979	1418	- 3	1121	1617	- 7	1285	1846	-11	1476	2112
	15	950	1380	11	1087	1572	7	1245	1794	3	1430	2052	- 1	1645	2351
	25	1049	1522	21	1201	1736	17	1379	1984	13	1585	2272	9	1827	2608
	35	1154	1673	31	1324	1911	27	1521	2187	23	1752	2508	19	2021	2882
15	- 5	612	1012	- 9	708	1158	-13	819	1327	-17	949	1523	-21	1101	1751
	5	687	1130	1	795	1295	- 3	921	1486	- 7	1069	1708	-11	1242	1966
	15	767	1257	11	889	1442	7	1031	1657	3	1198	1906	- 1	1393	2198
	25	853	1392	21	990	1599	17	1149	1839	13	1337	2119	9	1557	2446
	35	945	1537	31	1098	1767	27	1276	2035	23	1485	2347	19	1732	2713
30	- 5	470	919	- 9	553	1059	-13	651	1222	-17	766	1411	-21	902	1631
	5	533	1031	1	628	1189	- 3	739	1374	- 7	871	1588	-11	1026	1839
	15	602	1152	11	709	1330	7	835	1537	3	984	1780	- 1	1161	2063
	25	676	1281	21	797	1481	17	939	1714	13	1107	1986	9	1306	2305
	35	756	1420	31	891	1642	27	1051	1902	23	1240	2207	19	1463	2564

NOTE — This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-8 Minimum-Roll Take-Off Distances

Figure 4-9 Landing Distances

LANDING DISTANCES – HARD SURFACE

ASSOCIATED CONDITIONS:

POWER	IDLE
MIXTURE	RICH
FLAPS	35°
RUNWAY	LEVEL, DRY, HARD SURFACE
WEIGHT	2450 LB

LANDING SPEEDS:

AT 50 FT	70 KT
TOUCH-DOWN	61 KT

WIND COMPONENT DOWN RUNWAY KNOTS	SEA LEVEL				2000 FT				4000 FT				6000 FT				8000 FT			
	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET
0	23	-5	654	1409	16	-9	693	1467	9	-13	735	1532	2	-17	780	1600	-6	-21	828	1672
	41	5	678	1446	34	1	719	1509	27	-3	763	1575	20	-7	810	1644	13	-11	861	1724
	59	15	703	1484	52	11	745	1548	45	7	791	1617	38	3	840	1691	31	-1	894	1776
	77	25	727	1521	70	21	771	1587	63	17	819	1658	56	13	871	1740	49	9	926	1827
	95	35	751	1558	88	31	798	1626	81	27	847	1703	74	23	901	1788	67	19	959	1882
15	23	-5	496	1190	16	-9	530	1243	9	-13	567	1302	2	-17	607	1365	-6	-21	650	1431
	41	5	518	1222	34	1	553	1280	27	-3	592	1342	20	-7	634	1407	13	-11	679	1476
	59	15	539	1257	52	11	576	1317	45	7	617	1381	38	3	661	1448	31	-1	708	1520
	77	25	560	1291	70	21	600	1354	63	17	642	1420	56	13	688	1489	49	9	737	1565
	95	35	582	1326	88	31	623	1390	81	27	667	1458	74	23	715	1530	67	19	766	1614
30	23	-5	361	1005	16	-9	390	1049	9	-13	421	1095	2	-17	456	1149	-6	-21	493	1211
	41	5	379	1032	34	1	409	1078	27	-3	443	1127	20	-7	479	1188	13	-11	518	1252
	59	15	397	1060	52	11	429	1107	45	7	464	1163	38	3	502	1226	31	-1	544	1293
	77	25	416	1088	70	21	449	1138	63	17	486	1200	56	13	526	1264	49	9	569	1334
	95	35	434	1114	88	31	469	1172	81	27	508	1235	74	23	550	1303	67	19	595	1375

NOTE – This chart is based on data supplied by the manufacturer of the aircraft.

LANDING DISTANCES – GRASS SURFACE

ASSOCIATED CONDITIONS:

POWER	IDLE
MIXTURE	RICH
FLAPS	35°
RUNWAY	SHORT, DRY, LEVEL GRASS SURFACE
WEIGHT	2450 LB

LANDING SPEEDS:

AT 50 FT	70 KT
TOUCH-DOWN	61 KT

WIND COMPONENT DOWN RUNWAY KNOTS	SEA LEVEL				2000 FT				4000 FT				6000 FT				8000 FT			
	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET
0	23	-5	765	1520	16	-9	810	1586	9	-13	859	1657	2	-17	912	1732	-6	-21	969	1812
	41	5	793	1562	34	1	841	1631	27	-3	892	1704	20	-7	948	1782	13	-11	1007	1870
	59	15	822	1603	52	11	872	1675	45	7	925	1751	38	3	983	1834	31	-1	1046	1927
	77	25	851	1644	70	21	903	1719	63	17	959	1797	56	13	1019	1888	49	9	1084	1985
	95	35	879	1685	88	31	933	1762	81	27	992	1847	74	23	1054	1941	67	19	1122	2045
15	23	-5	581	1274	16	-9	621	1333	9	-13	663	1399	2	-17	710	1468	-6	-21	760	1542
	41	5	606	1310	34	1	647	1374	27	-3	693	1442	20	-7	741	1515	13	-11	794	1591
	59	15	631	1349	52	11	674	1415	45	7	722	1486	38	3	773	1561	31	-1	828	1640
	77	25	656	1387	70	21	701	1456	63	17	751	1529	56	13	804	1606	49	9	862	1691
	95	35	681	1425	88	31	729	1496	81	27	780	1571	74	23	836	1652	67	19	897	1744
30	23	-5	422	1066	16	-9	456	1115	9	-13	493	1167	2	-17	533	1226	-6	-21	576	1294
	41	5	443	1097	34	1	479	1147	27	-3	518	1202	20	-7	560	1269	13	-11	606	1340
	59	15	465	1127	52	11	502	1180	45	7	543	1242	38	3	588	1312	31	-1	636	1385
	77	25	486	1157	70	21	526	1214	63	17	568	1282	56	13	615	1354	49	9	666	1431
	95	35	508	1187	88	31	549	1252	81	27	594	1321	74	23	643	1396	67	19	696	1476

NOTE – This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-10 Landing Distances - Grass

TAKE-OFF DISTANCES – GRASS SURFACE

ASSOCIATED CONDITIONS:

POWER	FULL THROTTLE
MIXTURE	RICH
FLAPS	UP
RUNWAY	SHORT, DRY, LEVEL GRASS SURFACE
WEIGHT	2450 LB

TAKE-OFF SPEEDS:

LIFT OFF 70 KT

WIND COMPONENT DOWN RUNWAY KNOTS	SEA LEVEL				2000 FT				4000 FT				6000 FT				8000 FT			
	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET	OAT °F	OAT °C	GROUND ROLL FEET	TOTAL OVER 50 FT OBSTACLE FEET
0	23	-5	990	1665	16	-9	1129	1888	9	-13	1290	2146	2	-17	1477	2443	-6	-21	1693	2787
	41	5	1101	1848	34	1	1258	2100	27	-3	1439	2391	20	-7	1650	2726	13	-11	1896	3115
	59	15	1220	2045	52	11	1396	2327	45	7	1599	2653	38	3	1836	3030	31	-1	2113	3467
	77	25	1347	2255	70	21	1543	2569	63	17	1771	2933	56	13	2036	3354	49	9	2346	3844
	95	35	1482	2478	88	31	1700	2827	81	27	1954	3231	74	23	2249	3701	67	19	2595	4247
15	23	-5	786	1512	16	-9	902	1720	9	-13	1038	1960	2	-17	1196	2237	-6	-21	1381	2558
	41	5	878	1682	34	1	1009	1917	27	-3	1163	2187	20	-7	1342	2501	13	-11	1552	2865
	59	15	977	1865	52	11	1125	2128	45	7	1298	2432	38	3	1500	2785	31	-1	1737	3195
	77	25	1082	2060	70	21	1248	2353	63	17	1442	2693	56	13	1669	3088	49	9	1936	3548
	95	35	1196	2268	88	31	1381	2594	81	27	1597	2972	74	23	1851	3413	67	19	2149	3927
30	23	-5	603	1381	16	-9	699	1575	9	-13	811	1799	2	-17	943	2058	-6	-21	1098	2359
	41	5	678	1540	34	1	786	1758	27	-3	914	2011	20	-7	1064	2305	13	-11	1240	2647
	59	15	758	1710	52	11	881	1955	45	7	1025	2240	38	3	1195	2571	31	-1	1395	2957
	77	25	845	1892	70	21	983	2166	63	17	1145	2485	56	13	1336	2856	49	9	1562	3289
	95	35	938	2086	88	31	1092	2392	81	27	1273	2747	74	23	1488	3162	67	19	1741	3646

NOTE – This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-11 Take-Off Distances - Grass

PERFORMANCE DATA

TAKE-OFF DISTANCES

12. The take-off distances for minimum-roll and obstacle take-offs are given in Figure 4-7 and Figure 4-8. Distances are based on use of take-off techniques as described in Part 2 and the take-off and climb speeds given in Figure 4-5.

LANDING DISTANCES

13. The landing distances for normal landings are given in Figure 4-9. Both ground run and distance to clear a 50-foot obstacle are given. Distances are based on use of the normal landing technique given in Part 2 and the approach speed given in Figure 4-5.

CLIMB PERFORMANCE

14. Maximum climb performance figures for selected gross weights and altitudes are given in Figure 4-12. These figures are based on ICAO Standard Temperatures.

CRUISE PERFORMANCE

15. The cruise performance figures required for pre-flight planning are given in Figure 4-14 for altitudes up to 10 500 feet.

FUEL CONSUMPTION

16. Fuel consumptions for different power settings are given in Figure 4-14. The consumptions given are for level cruising flight with the mixture lean. RPM required to achieve the desired percentage of brake horsepower at the chosen altitude may be read directly or interpolated from Figure 4-14.

WEIGHT AND BALANCE

17. The graphs in Figures 4-15 to 4-17 provide the information required to determine the actual weight and balance of the aircraft and whether this is within the design weight and CG limits. Figure 4-16 contains the weight and moment information for the loading of occupants and baggage. Figure 4-17 gives the weight and CG envelopes for both Normal and Aerobatic Categories. Instructions for using each graph are given on the graph.

WEIGHT-AND-BALANCE CALCULATION

18. The following paragraphs outline a method of determining the maximum fuel that a Musketeer can carry while still remaining within the design weight and CG limits.

19. Using columns 1 and 2 of the chart (Figure 4-13), compute the total weight and moments of the aircraft exclusive of fuel. This will be referred to as the 'dry weight'. The point of intersection of these two values is the aircraft's CG and is applied to the CG graph in Figure 4-17.

20. The dry weight is now subtracted from the maximum allowable weight. The remainder represents the maximum fuel weight allowable under design weight limitations. Using columns 3 and 4, compute the new CG with the fuel and apply this point to the CG graph.

ALTITUDE	2450 LB		2300 LB		2150 LB		2000 LB	
	BEST RATE Knots IAS	RATE Ft/Min	BEST RATE Knots IAS	RATE Ft/Min	BEST RATE Knots IAS	RATE Ft/Min	BEST RATE Knots IAS	RATE Ft/Min
SEA LEVEL	81	820	80	955	79	1105	77	1275
4000 FEET	77	610	76	740	76	885	74	1050
8000 FEET	74	400	73	525	72	670	70	825

This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-12 Climb Performance

21. Join the two points with a straight line. If this line lies wholly within the CG envelope, it is safe to carry the maximum fuel calculated. If, on the other hand, this line crosses the forward CG line, the point of intersection is the maximum allowable weight. Subtract the dry weight previously calculated from this figure to determine the actual maximum allowable fuel weight, 1.58 pounds per litre, to determine the amount of fuel that can safely be carried in this situation.

22. The final weight and moments should then be re-calculated and applied to the CG chart to confirm their validity.

23. Figure 4-13 gives a sample weight and balance calculation.

NOTE - 1. The aircraft basic weight and basic moment/100 are obtained from the Aircraft Maintenance Set.

2. The moments for front- and rear-seat occupants and for baggage is derived from Figure 4-16 as directed on the graph.

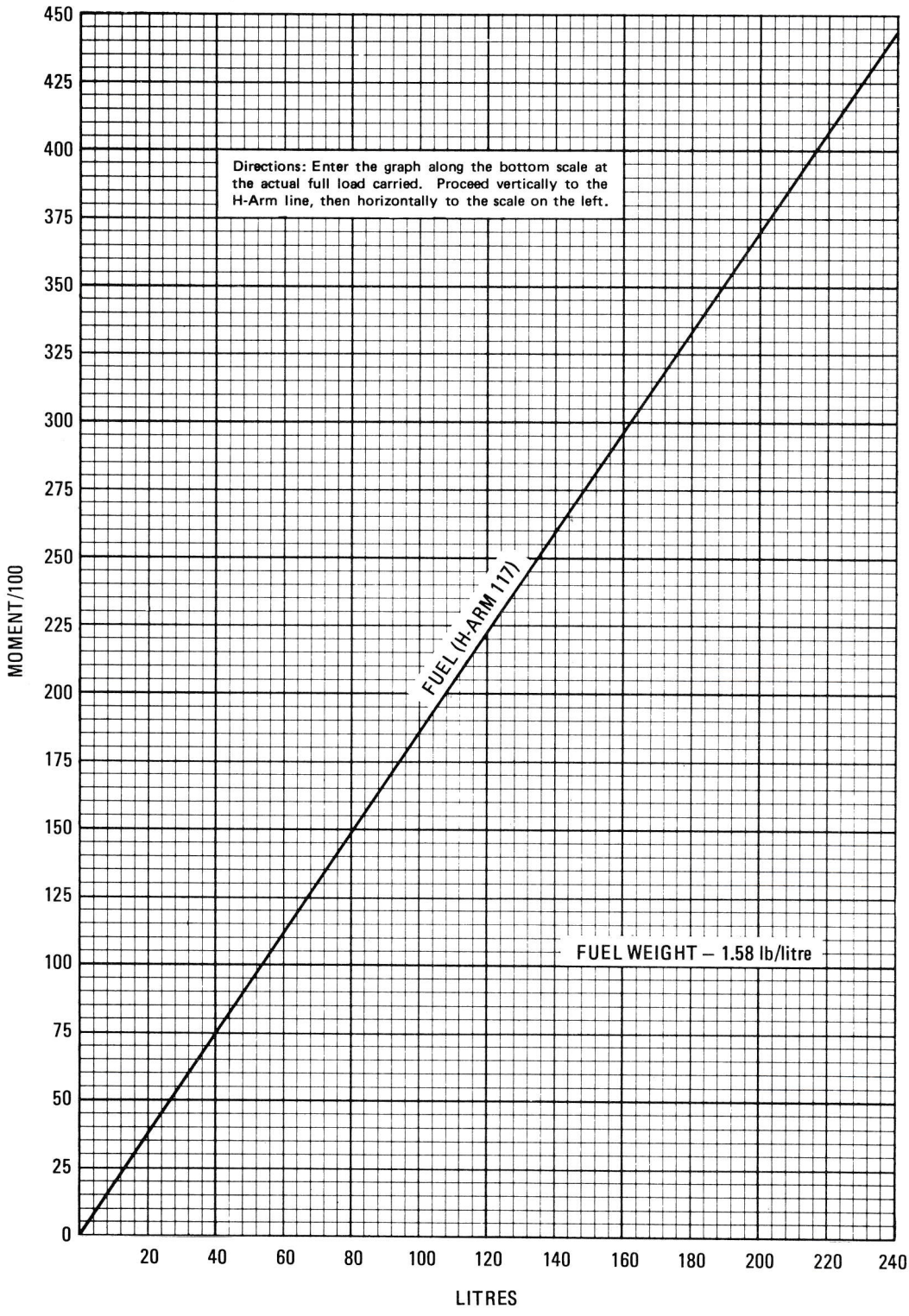
3. The moment for fuel is derived from Figure 4-15 as directed on the graph.

Load Factors	No Fuel		Fuel at Max Weight	
	Weight (lb)	Moment/ 100	Weight (lb)	Moment/ 100
Aircraft Basic Weight and Moment	1650	1800	1650	1800
Front Seat (160 lb + 180 lb)	340	367	340	367
Rear Seat (170 lb)	170	240	170	240
Baggage (100 lb)	100	167	100	167
Fuel (Max Weight - Dry Weight)	N/A	N/A	190	223
Total Weights & Moments	2260	2574	2450	2797

Figure 4-13
Weight-and-Balance Calculation

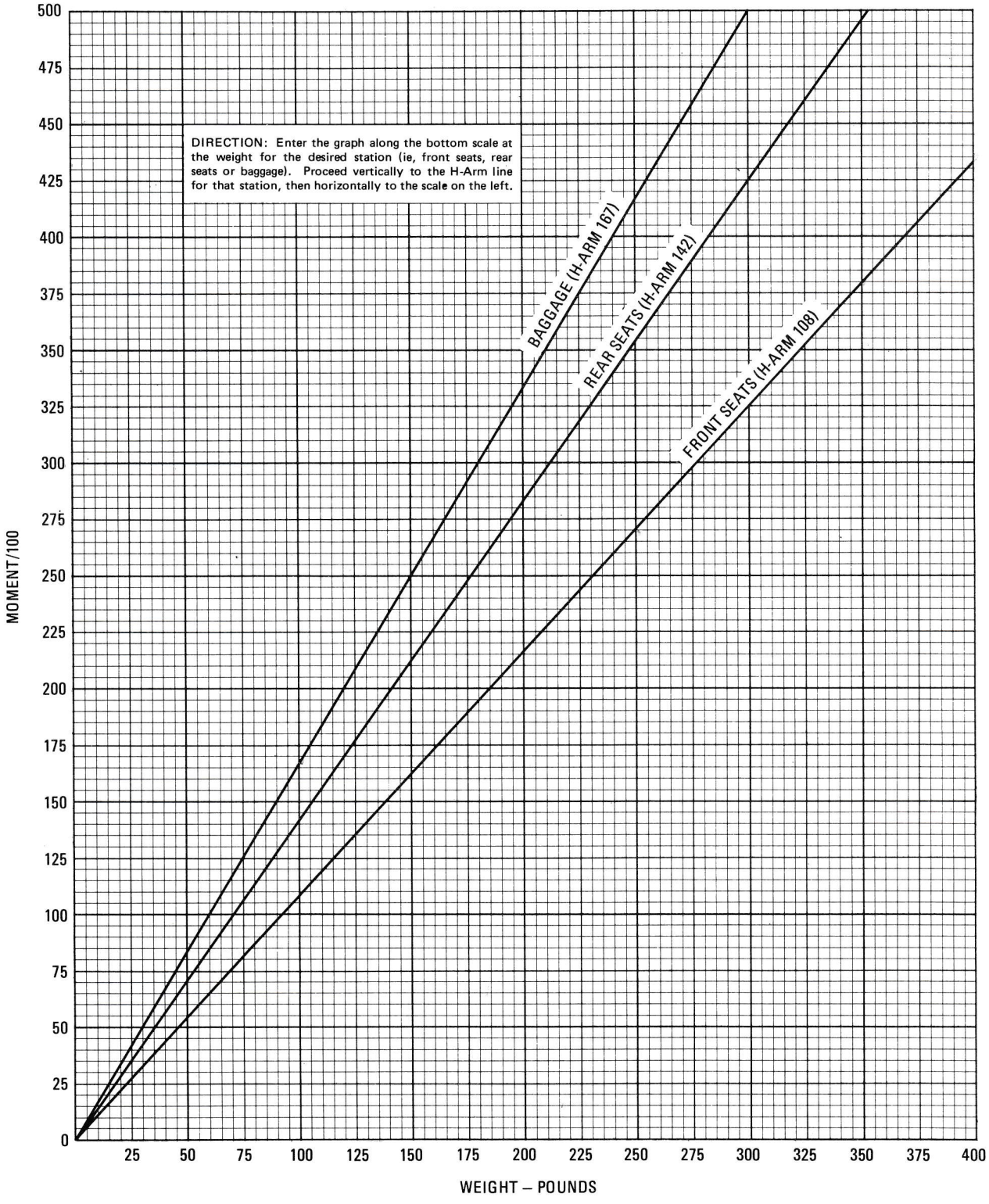
ALTITUDE FEET	POWER SETTINGS			TAS KTS
	RPM	% BHP	FUEL FLOW LITRES/HR	
2500	2700	88	50	124
	2500	73	39.4	113
	2300	60	31	100
3500	2700	86	48.4	123
	2500	71	38.2	112
	2300	59	30.6	99
4500	2700	84	47.3	123
	2500	70	37	111
	2300	59	30.3	98
5500	2696	82	45.4	122
	2500	68	36.3	110
	2300	58	29.9	97
6500	2688	79	43.9	121
	2500	67	35.5	109
	2300	58	29.9	96
7500	2680	77	42.4	120
	2500	66	34.8	109
	2300	57	29.9	95
8500	2670	75	40.8	119
	2500	65	34	108
	2300	57	29.5	94
9500	2662	73	39.6	117
	2500	64	33.3	107
	2300	57	29.5	93
10 500	2654	71	38.5	116
	2500	63	32.9	106
	2300	57	29.9	91

Figure 4-14
Cruise Performance and Fuel Consumption



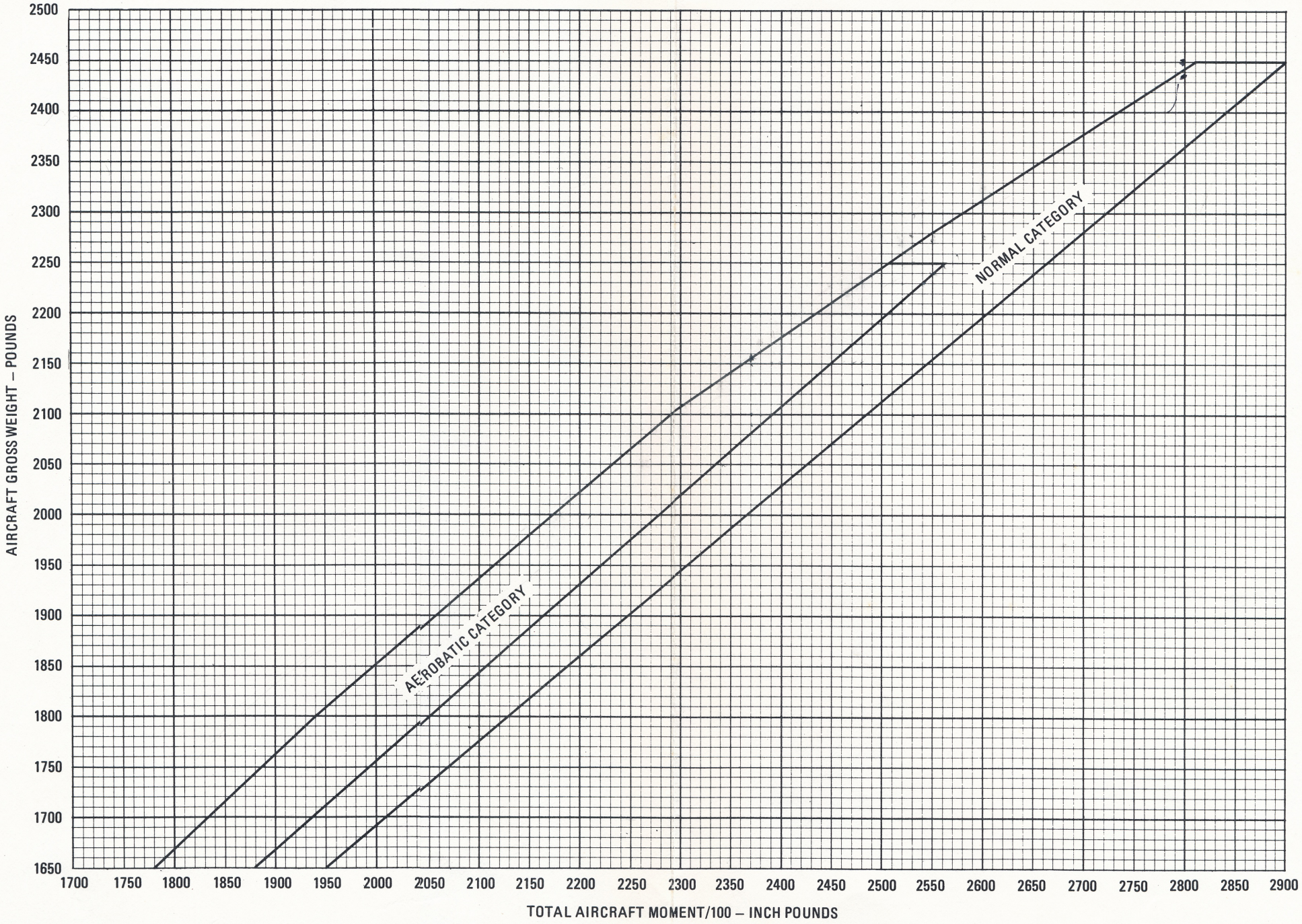
NOTE — This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-15 Weights and Moments for Fuel



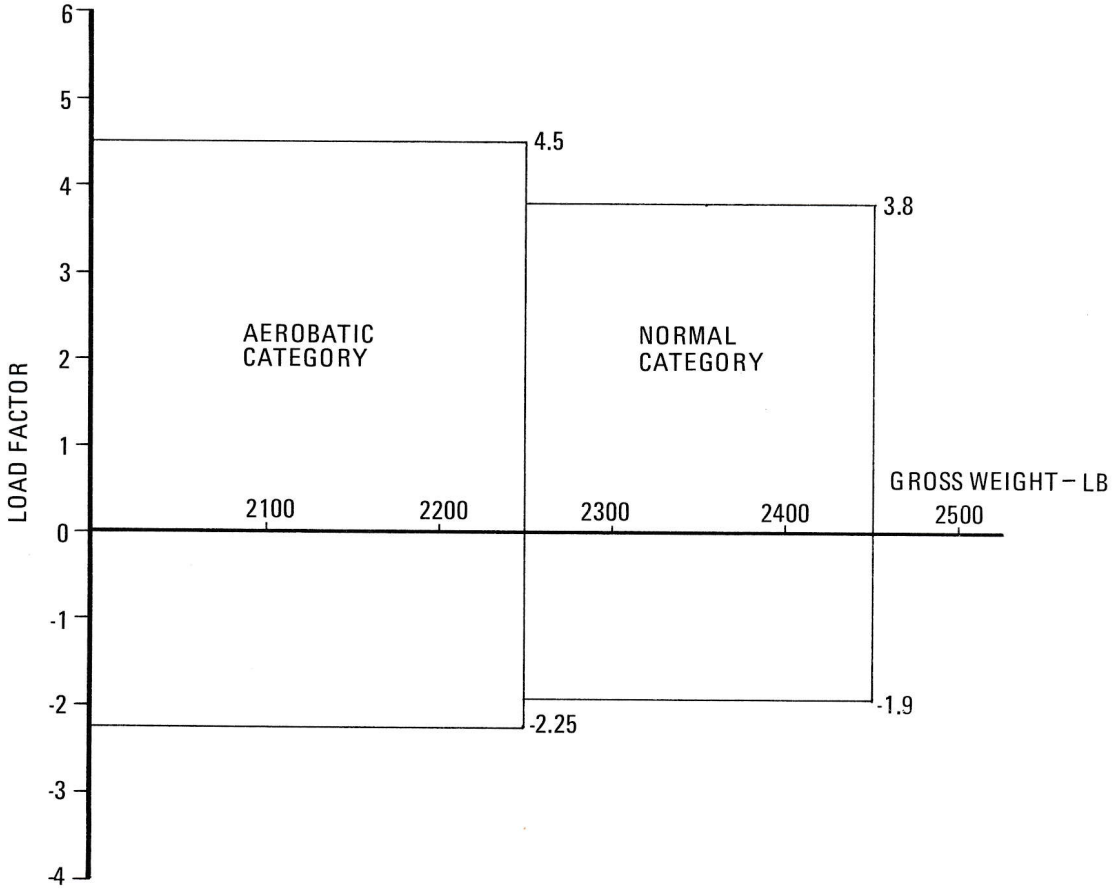
NOTE – This chart is based on data supplied by the manufacturer of the aircraft.

Figure 4-16 Weights and Moments for Baggage and Occupants



This chart is based upon data supplied by Aerospace Engineering Test Establishment

OPERATING ENVELOPE



OPERATING LIMITS

CONFIGURATION		POSITIVE	NEGATIVE	AIRSPEED LIMITS
CLEAN	NORMAL	3.8 G	1.9 G	152 KT IAS MAX DIVE OR GLIDE
	AEROBATIC	4.5 G	2.25 G	136 KT IAS MAX LEVEL OR CLIMB
FLAPS DOWN		1.9 G	O G	96 KT IAS

NOTE — Normal Category Limits are based on fatigue considerations. Aerobatic Category Limits are based on fatigue considerations and flight test data.

Figure 4-18 Load Factor Envelope

PART 5

FLIGHT TESTING PROCEDURES

GENERAL REQUIREMENTS

1. The procedures detailed in this part shall be observed during all flight testing of the Musketeer aircraft and its systems. The flight profile is shown in Figure 5-1. The flight test card is shown in Figure 5-2. The following rules also apply:

   a. All maintenance flight testing must be carried out in accordance with B-OA-100-001/AA-000 (CFP 100); C-05-020-007/AM-000, Part 8; and Parts 2, 3 and 4 of this CFTO.

   b. Ensure that weight and balance, as shown in Weight and Balance Data, are within specified limits.

NOTE - The test procedures in this part do not relieve the test pilot from complying with the procedures and checks as laid out in Parts 1 to 4 inclusive and the Musketeer Check List, C-12-134-000/MC-000. Items that are checked in normal operations are not detailed in this part, unless amplification is required.

BEFORE FLIGHT

EXTERNAL

2. Carry out all external checks, as detailed in Part 2, before entering the cockpit.

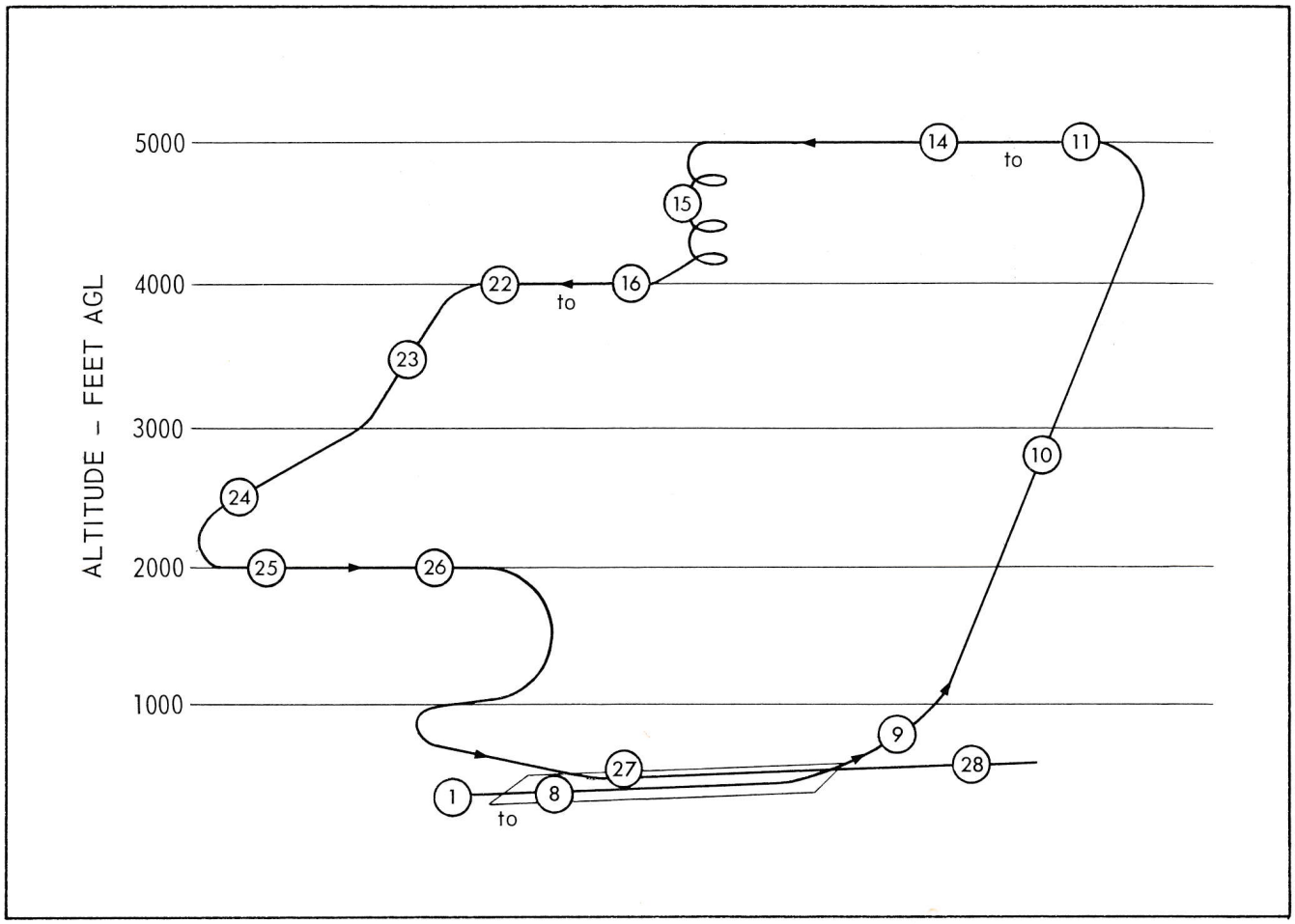


Figure 5-1 Flight Test Profile

FTC-4 JAN 83

MUSKETEER FLIGHT TEST CARD

AIRCRAFT DATE PILOT

TIME FUEL OAT TEST

1 This card is to be used in conjunction with C-12-134-A00/MB-000 Part 5 – Flight Testing. The number beside each section corresponds to the equivalent paragraph number in Part 5.

2 EXTERNAL	
CONTROLS (LESS RUDDER)	
STABILATOR TRIM	
LIGHTS	
3 PRE-START	
FUEL SELECTOR	
IGNITION SWITCH	
FUEL BOOST PUMPS	
ENGINE CONTROLS	
4 START	
OIL PRESSURE	
FUEL PRESSURE	
Without Fuel Boost	
With Fuel Boost	
5 PRE-TAXI	
ALTERNATOR	
PITOT HEAT	
6 RADIOS	
VHF-NAV-CCT BRKR	
7 TAXI	
ALTIMETER ERROR	
BRALES	
NOSE-WHEEL STEERING	

8 ENGINE CHECK	
(2200 RPM)	
MAGNETOS	
L- R-	
CARB HEAT	
OAT	
WIND VELOCITY	
FULL POWER	
MAX STATIC RPM	
OIL PRESSURE	
OIL TEMPERATURE	
FUEL PRESSURE	
AMMETER	
PARKING BRAKE (1800 RPM)	
IDLE RPM	
9 TAKE-OFF	
AIRSPEED (AIRBORNE)	
CONTROLS	
10 CLIMB	
RPM	
OIL TEMPERATURE	
OIL PRESSURE	
SUCTION	
MIXTURE	
TRIM	

11 LEVEL FLIGHT (110 KNOTS)	
RPM	
TRIM ADJUSTMENT	
T & S CENTRED	
12 COCKPIT VENTILATION	
CABIN AIR	
CABIN HEAT	
DEFROST	
FRESH-AIR VENTS-DRAFTS	
13 FLAPS	
14 STALL CHECKS (WARNING STALL)	
RUDDER CHECKS	
CLEAN	
LANDING-ATTITUDE	
15 SPIN	
CHARACTERISTICS (L + R)	
TRIMS AFTER SPIN (L + R)	
16 AEROBATICS	
17 T & S INDICATOR	
18 ATTITUDE INDICATOR	
19 ALTIMETER	
20 VSI	
21 AIRSPEED INDICATOR	

22 MAIN COMPASS SYSTEM	
23 SPEED/POWER CHECK	
OAT	
IAS	
PRESSURE ALTITUDE	
CABIN NOISE	
GRAPH-SPEED	
24 DESCENT - VN_E	
RPM (THROTTLE IDLE)	
A/S 70 KNOTS, TRIM FULL NOSE UP, A/S	
25 RADIOS	
VHF COMM	
ADF	
VOR/ILS	
TRANSPONDER	
26 FUEL SYSTEM	
27 LANDING & POST-LANDING	
BRAKE	
NOSE WHEEL	
IDLE RPM	
28 MISCELLANEOUS	
EMERGENCY EQUIPMENT	
AIRCRAFT CLEANLINESS	

(NOTE 'G' INDICATIONS BEFORE TAKE-OFF AND BEFORE SHUT-DOWN.)

REMARKS:

Aircraft Serviceable ☐ Date _____

Aircraft Unserviceable ☐ Test Pilot _____

Figure 5-2 Flight Test Card

a. Check aileron and stabilator controls for smooth and proper operation.

NOTE - Rudder operation should not be checked with aircraft stationary because of the possibility of imparting excessive strain to nose-wheel/rudder interconnecting linkage; however, with nose wheel straight, check to ensure that rudder pedals are even and that the bottom tip of the rudder lines up with offset seam in tail-cone fairing.

b. Check stabilator trim and ensure that trim indicator operates correctly and that the stabilator neutral position coincides with the neutral trim position on the indicator.

c. Check all internal and external lights for correct operation.

PRE-START

3. Carry out the Pre-Start Check as detailed in Part 2 and note the following:

a. Before selecting desired fuel tank, rotate fuel selector and ensure there is no roughness or binding. Also ensure that there is a positive detent feel at each tank and at the OFF position.

b. Before selecting BTY switch ON, move Magneto/START switch from OFF through L, R, BOTH, START, and back to OFF. Ensure switch moves freely without binding, springs back from START to BOTH when released and has positive detent in all but START position.

c. Select battery on, fuel selector to Left tank, and No. 1 fuel-booster pump ON. Note and record fuel-pressure reading. Select No. 1 fuel-booster pump OFF and rotate fuel selector to Right tank. Select No. 2 fuel-booster pump on and note and record fuel-pressure reading. Select No. 2 fuel-booster pump OFF.

NOTE - After switching from Left to Right fuel tanks a waiting period may be required to allow the fuel-pressure gauge reading to drop sufficiently to ensure an accurate reading is obtained on No. 2 fuel-booster pump.

d. Check throttle, carb heat, and mixture control levers by moving each control through full range. Ensure there is no binding or jamming and that the friction control operates normally.

START

4. Carry out normal start:

a. Record oil pressure.

b. Record fuel pressure:

(1) With fuel-boost pump OFF.
(2) With No. 1 then No. 2 fuel-boost pump ON.

PRE-TAXI

5. Before taxiing ensure, that the alternator is charging. Ensure pitot heat is operating by momentarily switching PITOT ON, and watching for slight flicker of ammeter pointer. Ensure accelerometer is zeroed. Return PITOT switch to off position.

6. Complete a functional check of intercommunications and avionics equipment. Where ground-test facilities are available, complete a functional check of radio navigation aids. Select avionics master switch OFF then pull slaved-gyro circuit breaker. With circuit breaker out, power should return to avionics system and the SLAVE-OFF flag should appear in the main compass indicator. Reset circuit breaker and select avionics master switch ON. System should return to normal operation.

TAXI

NOTE - Set altimeter to field altimeter setting and record elevation (± 50 feet of airfield elevation).

7. Check wheel brakes and nose-wheel steering while taxiing.

ENGINE CHECK

8. Complete the engine run-up and check/record the following:

a. Throttle set for 2200 RPM.

b. Check and record magneto drop (maximum drop - 125 RPM, maximum difference - 50 RPM).

c. Check CARB HEAT operation.

d. Record OAT.

e. Record wind velocity.

f. Set throttle for full power.

g. Record static RPM (2300 ± 50 RPM ISA).

h. Record oil pressure.

j. Record oil temperature.

k. Record fuel pressure.

m. Record ammeter reading.

n. Throttle set for 1800 RPM. Check to ensure that parking brake will hold aircraft at this RPM.

p. Throttle closed; record the RPM.

IN-FLIGHT

TAKE-OFF

9. During take-off, note and record airspeed at which aircraft becomes airborne; check control response.

CLIMB

10. Climb at full throttle, 90 knots IAS and record the following:

a. RPM.

b. Oil temperature, oil pressure, fuel pressure, suction.

c. Check MIXTURE control operation (engine RPM should increase and then start to drop off as mixture is leaned). Return to full rich.

d. Check trim.

LEVEL FLIGHT

11. Level the aircraft at 4000 feet AGL and adjust power to give 110 knots IAS.

a. Record RPM.

b. Trim aircraft for straight-and-level flight. With hands and feet off, note turn-and-slip indicator. Ball should remain centred with no tendency of aircraft to roll or yaw.

COCKPIT VENTILATION

12. Check operation of the following:

a. CABIN AIR control.

b. CABIN HEAT control.

c. Windshield DEFROST control.

d. Fresh air vents (6) - Check function and note any drafts in closed position.

FLAP OPERATION

13. To test flaps, proceed as follows:

a. Adjust power for 96 knots IAS.

b. Trim aircraft straight and level.

c. Fully extend the flaps.

d. Lateral trim should not change during flap operation.

e. Retract flaps.

STALL CHECKS

14. Prior to stalling the aircraft complete a full deflection rudder check. Aircraft should be set up at 110 knots IAS with turn and slip centred. Fully displace rudder pedals left and right while maintaining wings level with aileron. Check for progressive rudder force and ensure there is no binding or jamming throughout rudder travel. Check rudder self-centring action by displacing rudder fully in both directions and allowing rudder to return to neutral position without assistance.

NOTE - Rudder pedals should self-centre to within one inch (measured at rudder pedals) and slip indicator should return to within one and one-half ball widths of centre at normal cruise speed.

14A. A series of stalls is conducted to determine any undesirable flight characteristics involving severe wing drops or flick rolls and to check stall-warning operation. With at least 4000 feet AGL altitude perform power-off and power-on stalls and record stall-warning and stall speeds as follows:

a. **Clean stall** - Enter stall with nose about 15 degrees above horizon. Reduce power to idle, keeping straight with rudder. Maintain wings level and hold attitude until the aircraft stalls. Record airspeed at which stall warning begins to sound and airspeed at which aircraft stalls.

NOTE - Stall-warning buzzer should sound approximately 4 to 6 knots before aircraft stalls.

b. **Power-On/Landing-Attitude Stall** - Simulate final approach, flap fully down and 1500 RPM, allow airspeed to decrease to 60 knots, then round out until the stall occurs. Record stall warning and stall airspeed.

NOTE - Ailerons should remain effective up to the stall.

SPIN

15. Proceed as follows:

a. Spin aircraft both left and right with power off and flaps up. The aircraft should make two full turns.

b. Record any normal characteristics.

c. Check trims after spinning.

AEROBATICS

16. Perform several aerobatic manoeuvres and note any adverse handling characteristics. Note accelerometer indications.

TURN-AND-SLIP INDICATOR

17. Proceed as follows:

a. Trim aircraft in straight-and-level flight at 110 knots IAS.

b. Establish and hold a rate-1 turn through 360 degrees to the right, then to the left.

c. Ensure that the time lapse for the complete turn is 2 minutes. Ensure that during manoeuvres, the pointer and ball move freely. Cross-check the attitude indicator for bank angle.

NOTE - A momentary indication of a turn in the opposite direction may occur as the turn is initiated.

ATTITUDE INDICATOR

18. During the turns to check the turn pointer, also check the attitude indicator. The angle of bank should be approximately 18 degrees. On straightening out from each turn, the bank angle error should not exceed 5 degrees.

ALTIMETER

19. The pointer should move positively and without hesitation under normal flying conditions.

VERTICAL-SPEED INDICATOR

20. Check the instrument's accuracy against a timed climb or descent.

AIRSPEED INDICATOR

21. The airspeed indicator should be checked at different airspeeds during the flight. There should be no pointer oscillations other than those that may be caused by turbulence.

MAIN COMPASS SYSTEM

22. The main compass system should be checked in both slave No. 1 and slave No. 2 positions for accurate operation and proper annunciator indications. Ensure that slave-off flag disappears during slaved operation and is visible in the free gyro mode.

SPEED/POWER CHECK

23. The speed/power check should be carried out at minimum smooth-air altitude. Proceed as follows:

a. Open throttle to 2700 RPM (or full throttle).

b. Lean mixture to maximum RPM (not to exceed 2700 RPM).

c. Trim for straight and level flight.

d. Record OAT.

e. Record IAS.

f. Record pressure altitude (29.92).

g. Check cabin noise.

h. Compare IAS achieved with graph (Figure 5-3).

DESCENT

24. The following provides a check of engine compression and stabilator trim adjustment. Proceed as follows:

a. Enter descent, maintaining 2600 RPM.

b. When VN_E is achieved, close throttle.

c. Maintain VN_E and record engine RPM. Engine RPM should stabilize at approximately 2200 RPM.

d. Ease up nose and reduce airspeed to 70 knots IAS.

e. Trim full nose up. Airspeed should stabilize at approximately 62 ± 5 knots IAS. (Aerobatic category 57 ± 5 knots IAS).

RADIOS

25. To check radio equipment, proceed as follows:

a. Check VHF communication equipment at altitude, on appropriate tower frequency, for strength, clarity and freedom from interference.

b. Check ADF by tuning in local beacon. Fly inbound on an east/west heading and outbound on a north/south heading. With ADF centred on 090/270-180/360 degrees, check accuracy of headings flown by reference to section lines making due allowance for magnetic variation. Headings should be accurate to within ± 4 degrees.

c. Where facilities exist, carry out a similar check of the VOR by using section lines as a reference. Set appropriate radial, corrected for magnetic variation. Fly inbound and outbound, noting amount of pointer deflection. Pointer should be accurate to within ±2 degrees.

d. Conduct an ILS approach to ensure localizer and glideslope are functioning correctly.

e. Complete functional check of the transponder with an appropriate ground facility to include a code 7700.

FUEL SYSTEM

26. Check fuel system operation as follows:

a. Select alternate fuel tank. With FUEL BOOST pump OFF, fuel pressure should remain steady and engine should continue to run smoothly with no hesitation.

b. Select fuel OFF. Fuel pressure should gradually drop to zero and engine should cease firing. Reselect desired fuel tank; engine should recover to previous RPM within 10 seconds maximum.

POST-FLIGHT

LANDING AND POST-LANDING

27. Carry out the following:

a. Check for nose-wheel shimmy during after-landing roll.

b. Recheck brakes for indications of grabbing or fade.

NOTE - Use brief, gentle brake applications to prevent excessive wear and over-heating.

c. Prior to engine shut-down, recheck engine idle RPM.

d. On shut-down, check operation of mixture idle cut-off.

MISCELLANEOUS

28. Carry out the following:

a. Check and ensure that emergency maps, crash instructions, survival and first-aid equipment are properly stowed and secured.

b. Check cleanliness of aircraft both inside and out and note particularly any evidence of oil leaks after flight.

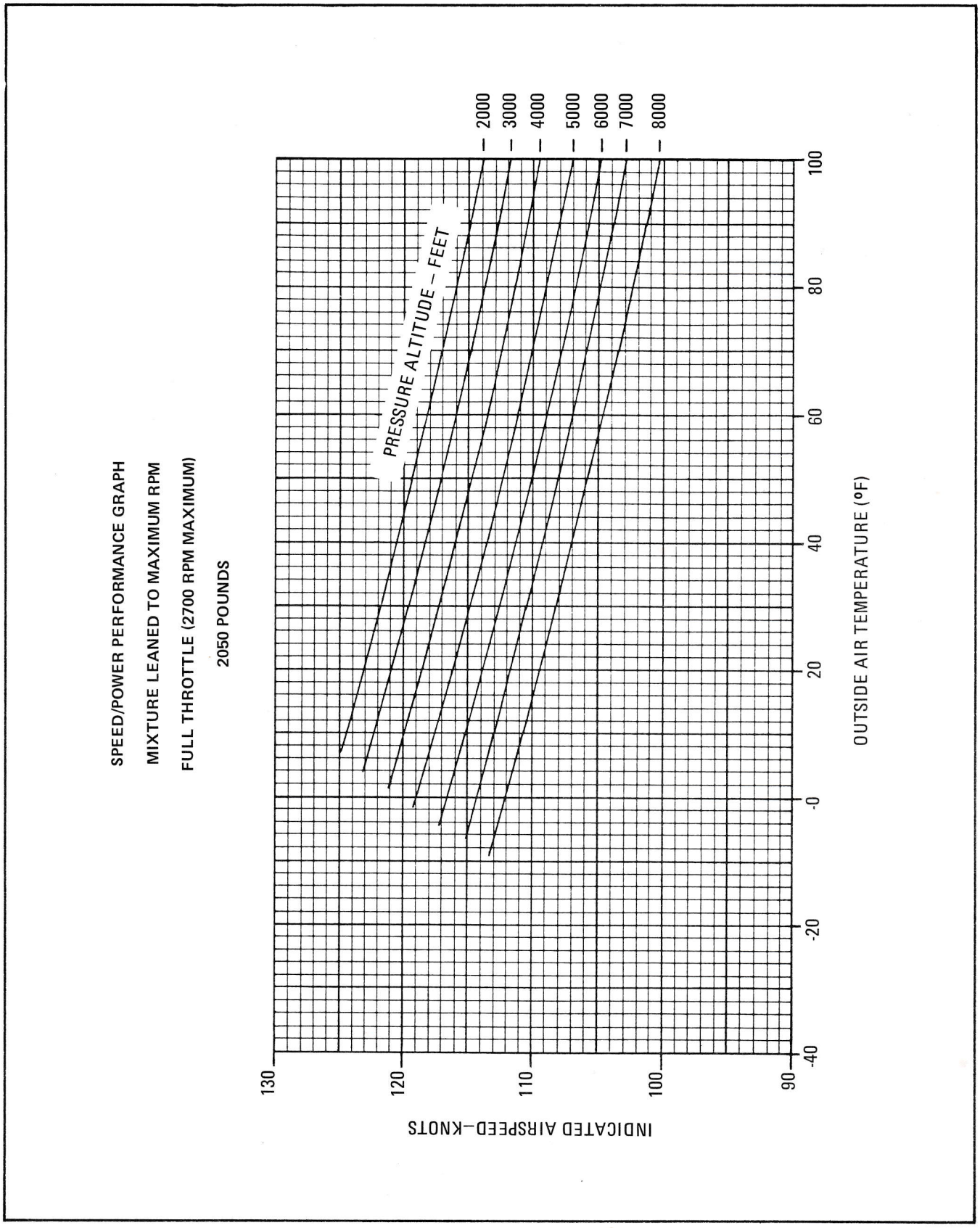


Figure 5-3 Speed/Power Performance Graph